

## 2. Subbasin Assessment – Water Quality Concerns and Status

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This section describes the water quality concerns and status of the 303(d)-listed water bodies in the Palouse River Subbasin. Included in the discussion are the following:

- A description of the 303(d)-listed water bodies and the justification for their 303(d) listing.
- An overview of the water quality data used in the subbasin assessment to analyze and compare the different listed water bodies. The data presented illustrate which 303(d)-listed water bodies are truly impaired and require a TMDL to improve water quality, and which water bodies are not in need of a TMDL because beneficial uses are being met.
- Various characteristics of the 303(d) water bodies, such as are displayed in Tables 2-1 through 2-9, Figures 2-1 through 2-49, and Maps 2-1 through 2-6.
- Recommendations for each 303(d)-listed water body.

### 2.1 Water Quality Limited Assessment Units Occurring in the Subbasin

Within the Palouse River Subbasin (HUC #17060108) there are eight water bodies on the 1998 303(d) list. Two of these water bodies, Cow Creek and the South Fork Palouse River, will be addressed in separate subbasin assessments and TMDLs. The remaining six water bodies are addressed in this document.

Table 2-1 lists all the 303(d) water bodies and their boundaries, listing basis, pollutants, segment IDs, and designated uses. All of these streams are listed because they were listed as impaired in *The 1992 Idaho Water Quality Status Report*, Appendix D (DEQ 1992) as being impaired. When these water bodies were placed on the original 303(d) list in 1994, there was a very limited amount of data if any at all to support their listing. All of these water bodies were placed on the 303(d) list because of “evaluated” information; meaning best professional judgment was used at the time. Since then, sufficient data has been collected to properly assess these water bodies.

In this report the West Fork of Rock Creek (WFRC) and Rock Creek are considered to be the same watershed. On the 303(d) list, the WFRC is listed with the boundaries being the headwaters to the Palouse River. This is not correct; technically, the WFRC joins with the East Fork of Rock Creek (EFRC) to form Rock Creek, which flows into the Palouse River. We looked at the entire Rock Creek watershed, from headwaters to the Palouse River, and in this document it is referred to as Rock Creek, which is technically more correct.

**Table 2-1. §303(d) segments in the Palouse River Subbasin.**

<b>Water body Name</b>	<b>Assessment Units</b>	<b>1998 §303(d)<sup>1</sup> Boundaries</b>	<b>Pollutants<sup>2</sup></b>	<b>Listing Basis<sup>3</sup></b>
Big Creek	ID1706108CL027a_02 ID1706108CL027b_02	HW <sup>4</sup> to Palouse R.	Sed, Nut, Temp, Bac	A
Deep Creek	ID1706108CL032a_02 ID1706108CL032a_03 ID1706108CL032b_02 ID1706108CL032b_03	HW to Palouse R.	Sed, Nut, Temp, Bac	A, B
Flannigan Creek	ID1706108CL011a_02 ID1706108CL011a_03 ID1706108CL011b_02 ID1706108CL011b_03	HW to Palouse R.	Sed, Nut, Temp, Bac	A
Gold Creek	ID1706108CL029_02 ID1706108CL029_03 ID1706108CL030_02 ID1706108CL031a_02 ID1706108CL031b_02	Waterhole Cr. to Palouse R.	Sed, Nut, Temp, Bac	A
Hatter Creek	ID1706108CL015a_02 ID1706108CL015b_02 ID1706108CL015b_03	HW to Palouse R.	Sed, Nut, Temp, Bac	A
Rock Creek	ID1706108CL012_03 ID1706108CL013a_02 ID1706108CL013b_03 ID1706108CL014a_02 ID1706108CL014b_02	HW to Palouse R. (West Fork Rock Creek)	Sed, Nut, Temp, Bac	A

<sup>1</sup> Refers to a list created in 1998 of water bodies in Idaho that did not fully support at least one beneficial use.

This list is required under section 303 subsection “d” of the Clean Water Act.

<sup>2</sup> Sed = Sediment, Nut = Nutrients, Temp = Temperature, Bac = Bacteria

<sup>3</sup> Listing Basis A= Streams were on the 1992 305(b) report, B = Information submitted by the Columbia River Intertribal Fish Commission

<sup>4</sup> HW = Headwaters

## 2.2 Applicable Water Quality Standards

This section covers the applicable water quality standards and water quality criteria for the 303(d)-listed segments in the Palouse River Subbasin. The determination of the existing and designated beneficial uses is discussed in this section, and the results are displayed in Table 2-2. A description of the different kinds of beneficial uses, and what those specific beneficial uses are, is also included in this section.

### Beneficial Uses

Idaho water quality standards require that surface waters of the state be protected for beneficial uses, wherever attainable (IDAPA 58.01.02.050.02). These beneficial uses are interpreted as existing uses, designated uses, and “presumed” uses as briefly described in the

following paragraphs. The *Water Body Assessment Guidance*, second edition (DEQ 2002) gives a more detailed description of beneficial use identification for use assessment purposes.

### Existing Uses

Existing uses under the CWA are “those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards.” The existing in stream water uses and the level of water quality necessary to protect the uses shall be maintained and protected (IDAPA 58.01.02.003.35, .050.02, and 051.01 and .053). Existing uses include uses actually occurring, whether or not the level of quality to fully support the uses exists. Practical application of this concept would be when a water body could support salmonid spawning, but salmonid spawning is not occurring due to water quality impairment.

### Designated Uses

Designated uses under the CWA are “those uses specified in water quality standards for each water body or segment, whether or not they are being attained.” Designated uses are simply uses officially recognized by the state. In Idaho these include aquatic life support, recreation in and on the water, domestic water supply, and agricultural use. Water quality must be sufficiently maintained to meet the most sensitive use. Designated uses may be added or removed using specific procedures provided for in state law, but the effect must not be to preclude protection of an existing higher quality use such as cold water aquatic life or salmonid spawning. Designated uses are specifically listed for water bodies in Idaho in tables in the Idaho water quality standards (see IDAPA 58.01.02.003.22 and .100, and IDAPA 58.01.02.109-160 in addition to citations for existing uses).

### Presumed Uses

In Idaho, most water bodies listed in the tables of designated uses in the water quality standards do not yet have specific use designations. These undesignated uses are to be designated. In the interim, and absent information on existing uses, DEQ presumes that most waters in the state will support cold water aquatic life and either primary or secondary contact recreation (IDAPA 58.01.02.101.01). To protect these so-called “presumed uses,” DEQ will apply the numeric criteria cold water and primary or secondary contact recreation criteria to undesignated waters. If in addition to these presumed uses, another existing use, (e.g., salmonid spawning) exists, because of the requirement to protect levels of water quality for existing uses, then the additional numeric criteria for salmonid spawning would additionally apply (e.g., intergravel dissolved oxygen, temperature). However, if for example, cold water is not found to be an existing use, a use designation to that effect is needed before some other aquatic life criteria (such as seasonal cold) can be applied in lieu of cold water criteria. (IDAPA 58.01.02.101.01).

**Table 2-2. Palouse River Subbasin designated and existing beneficial uses.**

<b>Water body</b>	<b>Designated Uses<sup>1</sup></b>	<b>Existing Uses</b>	<b>1998 §303(d) List Boundaries<sup>2</sup></b>
Big Cr.	Upper - CW, SS, SCR Lower - CW, SCR	Upper - CW, SS, SCR Lower - CW, SCR	HW <sup>4</sup> to Palouse R.
Deep Cr.	CW, SCR	CW, SCR	HW to Palouse R.
Flannigan Cr.	CW, SCR	Upper - CW, SS, SCR Lower - CW, SCR	HW to Palouse R.
Gold Cr.	Upper - CW, SS, SCR Lower - CW, SCR	Upper - CW, SS, SCR Lower - CW, SCR	Waterhole Cr. to Palouse R.
Hatter Cr.	CW, SCR	CW, SS, SCR	HW to Palouse R.
Rock Cr.	CW, SCR	CW, SCR	HW to Palouse R.

<sup>1</sup>CW - Cold Water, SS - Salmonid Spawning, SC - Seasonal Cold Water, PCR - Primary Contact Recreation, SCR - Secondary Contact Recreation, DWS - Domestic Water Supply

<sup>2</sup>Refers to a list created in 1998 of water bodies in Idaho that did not fully support at least one beneficial use. This list is required under section 303 subsection "d" of the Clean Water Act.

### Water Quality Standards

By law, Idaho must protect designated beneficial uses of surface waters: aquatic life, recreation, water supply, wildlife habitats, and aesthetics (IDAPA 58.01.02.100).

#### Aquatic Life

Protections for aquatic life beneficial uses include the following:

- *Cold water (COLD)*: waters quality appropriate for the protection and maintenance of a viable aquatic life community for cold water species.
- *Salmonid spawning (SS)*: waters that provide or could provide a habitat for active self-propagating populations of salmonid fishes.
- *Seasonal cold water (SC)*: water quality appropriate for the protection and maintenance of a viable aquatic life community of cool and cold water species, where cold water aquatic life may be absent during, or tolerant of, seasonally warm temperatures.
- *Warm water (WARM)*: water quality appropriate for the protection and maintenance of a viable aquatic life community for warm water species.

## Recreation

*Primary contact recreation (PCR):* water quality appropriate for prolonged and intimate contact by humans or for recreational activities when the ingestion of small quantities of water is likely to occur. Such activities include, but are not restricted to, swimming, water skiing, and skin diving.

*Secondary contact recreation (SCR):* water quality appropriate for recreational uses on or about the water and which are not included in the primary contact category. These activities may include fishing, boating, wading, infrequent swimming, and other activities where ingestion of raw water is not likely to occur.

## Water Supply

*Domestic:* water quality appropriate for drinking water supplies.

*Agricultural:* water quality appropriate for the irrigation of crops or drinking water for livestock. This use applies to all surface waters of the state.

*Industrial:* water quality appropriate for industrial water supplies. This use applies to all surface waters of the state.

## Wildlife habitats

*Wildlife:* water quality appropriate for wildlife habitats. This use applies to all surface waters of the state.

## Aesthetics

This use applies to all surface waters of the state.

DEQ asserts in IDAPA 58.01.02.101.01 that cold water aquatic life and primary or secondary contact recreation will be applied to all waters that do not have designations.

## Criteria For Protecting Existing Uses

The following general water quality criteria apply to all surface waters of the state in addition to the water quality criteria set forth for specifically designated waters.

- *Hazardous Materials:* Surface waters of the state shall be free from hazardous materials concentrations found to be of public health significance or to impair designated beneficial uses. These materials do not include suspended sediment produced because of nonpoint source activities.

- *Toxic Substance:* Surface waters of the state shall be free from toxic substances in concentrations that impair designated beneficial uses. These substances do not include suspended sediment produced as a result of nonpoint source activities.
- *Deleterious Materials:* Surface waters of the state shall be free from deleterious materials in concentrations found to be of public health significance or to impair designated beneficial uses. These materials do not include suspended sediment produced as a result of nonpoint source activities.
- *Radioactive Materials:* Radioactive materials or radioactivity shall not exceed the values listed in the Code of Federal Regulations, Title 10, Chapter 1, Part 20, Appendix B, Table 2, *Effluent Concentrations*, Column 2. Radioactive materials or radioactivity shall not exceed concentrations required to meet standards set forth in Title 10, Chapter 1, Part 20 of the Code of Federal Regulations for maximum exposure of critical human organs in the case of foodstuffs harvested from these waters for human consumption.
- *Floating, Suspended or Submerged Matter:* Surface waters of the state shall be free from floating, suspended, or submerged matter of any kind in concentrations causing nuisance or objectionable conditions or that may impair designated beneficial uses. This matter does not include suspended sediment produced as a result of nonpoint source activities.
- *Excess Nutrients:* Surface waters of the state shall be free from excess nutrients that can cause visible slime growths or nuisance aquatic growths impairing designated beneficial uses.
- *Oxygen-Demanding Materials:* Surface waters of the state shall be free from oxygen-demanding materials in concentrations that would result in an anaerobic water condition.
- *Sediment:* Sediment shall not exceed quantities specified in IDAPA 58.01.02 Section 250 and 252, or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses. Determinations of impairment shall be based on water quality monitoring and surveillance and the information utilized as described in Subsection 350.02.
- *Natural Background Conditions:* When natural background conditions exceed any applicable water quality criteria set fourth in IDAPA 58.01.02 Sections 210, 250, 251, 525, or 253, the applicable water quality criteria shall not apply; instead, pollutant levels shall not exceed the natural background conditions, except that temperature levels may be increased above natural background conditions when allowed under IDAPA 58.01.02 Section 401.

In addition to the general water quality criteria, there are specific criteria that apply to waters of the state. Selected criteria from IDAPA 58.01.02. that are applicable to the Palouse River Subbasin are listed in Table 2-3.

**Table 2-3. Surface water quality criteria.<sup>1</sup>**

Use	Water Quality Criteria
<b>Primary Contact Recreation</b>	For areas within waters designated PCR that are additionally specified as public swimming beaches, a single sample of 235 <i>E. coli</i> organisms per 100ml. A single sample of 406 <i>E. coli</i> organisms per 100ml or a geometric mean of 126 <i>E. coli</i> organisms based on a minimum of five samples taken every three to five days over a 30 day period is a violation.
<b>Secondary Contact Recreation</b>	A single sample of 576 <i>E. coli</i> organisms per 100ml or a geometric mean of 126 <i>E. coli</i> organisms based on a minimum of five samples taken every three to five days over a 30 day period is a violation.
<b>Cold Water Aquatic Life</b>	Surface waters are not to vary from the following characteristics due to human activities: pH between 6.5 and 9.0. DO <sup>4</sup> must be greater than 6.0 (milligrams per liter) mg/L at all times in the water column. In lakes and reservoirs this does not apply to the bottom 20% where depths are less than 35 meters. Turbidity below any mixing zone set by the DEQ shall not exceed background turbidity by more than 50 NTU <sup>5</sup> instantaneously or more than 25 for NTU more than 10 consecutive days. Water temperature must be equal to or less than 22°C with a maximum daily average of no greater than 19°C.
<b>Salmonid Spawning</b>	Surface waters are not to vary from the following characteristics due to human activities: pH between 6.5 and 9.0. DO must be greater than 6.0mg/L or 90% of the saturation, whichever is greater. Water temperature must be equal to or less than 13°C with a maximum daily average of no greater than 9°C. Bull trout- water temperatures shall not exceed 13°C maximum weekly maximum temperature during June, July and August for juvenile bull trout rearing, 9°C daily average during September and October for bull trout spawning.
<p style="text-align: center;"><b>Temperature</b></p> <p>Measuring Purposes—the daily average shall be generated from a recording device with a minimum of six (6) evenly spaced measurements in a 24-hour period.</p> <p>Exemption -Exceeding the water quality temperature criteria will not be considered a water quality standard violation when the air temperature exceeds the ninetieth (90th) percentile of the seven (7) day average daily maximum air temperature calculated in yearly series over the historic record measured at the nearest weather reporting station.</p> <p><i>* These above two standards do not apply to the federally promulgated bull trout streams or temperature criteria.</i></p> <p>EPA Bull Trout Temperature Criteria: Water Quality standards for Idaho (40 CFR Part 131.33(a)): "A temperature criterion of 10°C expressed as average of daily maximum temperatures over a seven-day period which applies...during the months of June, July, August and September."</p>	

<sup>1</sup> IDAPA58.01.02<sup>2</sup> PCR = Primary Contact Recreation<sup>3</sup> SCR = Secondary Contact Recreation<sup>4</sup> DO-Dissolved Oxygen<sup>5</sup> NTU- nephelometric turbidity unit

## 2.3 Summary and Analysis of Existing Water Quality Data

In this section, the various data sets that were collected and analyzed are discussed. Below is a list of the various water quality data used in this document. Collectively, this data was used to determine whether or not the streams in question are water quality impaired. A majority of the analysis comes from the data collected by DEQ-LRO, Idaho Association of Soil Conservation Districts (IASCD), and the Latah Soil and Water Conservation District (LSWCD) during November 2001 and November 2002. A monitoring plan was jointly developed by DEQ-LRO, IASCD, LSWCD, and the Department of Agriculture and is located in Appendix A.

Water quality data sources used during this assessment included the following:

- DEQ-LRO, IASCD, LSWCD Monitoring Data—Year 2001-2002
- GIS Analysis
- Beneficial Use Reconnaissance Program (BURP) data, WBAG II process
- Cumulative Watershed Effects (CWE) process data
- Revised Universal Soil Loss Equation (RUSLE)
- Watershed Erosion Prediction Project (WEPP)-road analysis
- In-Stream Erosion
- Clearwater National Forest (CNF) Stream Bio-Physical Studies reports
- Stream temperature data
- Fish data
- Flow data

Each of these data sources are described in the following.

### DEQ- IASCD Monitoring Data—Year 2001-2002

In 2001, DEQ collaborated with IASCD, the Latah Soil and Water Conservation District, the Idaho Soil Conservation Commission, the Idaho State Department of Agriculture, and local landowners in developing a monitoring plan designed to complete the following goals:

- Evaluate the water quality and discharge rates at selected locations on each 303 (d) listed tributary
- Attempt to determine which areas contribute to water quality exceedances or degradation
- Prioritize loading areas that may require BMP implementation or other possible management strategies
- Determine the relationship between turbidity and total suspended solids
- Make data available to the public

The plan was implemented and executed from November 2001 through November 2002. The following analyses were performed on collected water samples: total phosphorus (TP), nitrate and nitrite ( $\text{NO}^2/\text{NO}^3$ ), ammonia ( $\text{NH}^4$ ), total suspended solids (TSS), and fecal and total coliform counts. Other parameters collected in the field included flow, pH, specific conductivity, dissolved oxygen (DO), and air and water temperatures. A map located on the last page of the monitoring plan (Appendix A) displays the locations of the monitoring stations.

Sample collection began in November of 2001 and continued for a full calendar year, with IASCD, LSWCD, and DEQ staff sampling the sites every two weeks. At times during the year, some sites were not sampled: in the winter and spring, snow and large runoff events made accessibility and sampling impossible, and in the summer some sites were dry.

This monitoring plan was the backbone of this TMDL and subbasin assessment. The data collected was the primary determining factor as to whether or not the 303(d) streams need a TMDL. For more detailed information, please refer to the actual monitoring plan, located in Appendix A.

### GIS Analysis

Using GIS software, watersheds were delineated for 303(d)-listed streams, so that the Revised Universal Soil Loss Equation (RUSLE), Watershed Erosion Prediction Project (WEPP), and Potential Natural Vegetation (PNV) models could be used to quantify pollutant loads. In addition, all of the maps used in this document were made using the GIS.

GIS is a powerful tool for illustrating, comparing, calculating, and analyzing data in a way not previously possible. For example, GIS-provided information, like total stream miles, acres of forested land, agricultural land, and road miles, were used in this report.

Although GIS attempt to represent actual conditions on the ground, it is important to note that the data used for GIS analysis may not be completely accurate. There is no one central GIS database; it was necessary to gather, compile, change, modify, and create data from various sources. In addition, landscape conditions change somewhat rapidly: roads are obliterated or built, timber is removed while trees are growing, ownership changes, streams shift, etc. To update the database for the Palouse River Subbasin continually at this scale would be impossible given the resources available. With that said, the best data currently available has been compiled and is presented in this report. The following is the disclaimer from DEQ regarding data usage in GIS Analysis. "Restriction of liability: Neither the State of Idaho nor the Idaho Department of Environmental Quality, nor any of their employees make any warranty, express or implied, or assume any legal liability or responsibility for the accuracy, completeness or usefulness of any information or data provided. Metadata is provided for all data sets, and no data should be used without first reading and understanding its limitations. The data could include technical inaccuracies or typographical errors. The Department of Environmental Quality may update, modify, or revise the data used at any time, without notice."

## BURP Data and WBAG II

Developed from rapid bioassessment concepts developed by EPA, BURP is a DEQ water-monitoring program that has been in existence for nearly a decade. Each year, between July and September, BURP crews collect biological, chemical, and physical data. This data is used to determine whether a water body is supporting its designated beneficial uses. BURP is a good tool to evaluate biological changes in the environment:

- The BURP process collects data on macroinvertebrates, fish, other aquatic life, and stream physical habitat
- BURP data is easily reproducible and an extensive database has been established with this data
- BURP information collected will be valuable in future years to evaluate the condition of the water bodies in the state, including the Palouse River Subbasin

BURP surveys were completed on the 303(d) streams in the Palouse River Subbasin during the summer monitoring seasons of 1996 and 2002.

WBAG II is a guidance document used by DEQ to determine whether a water body fully supports designated and existing beneficial uses, relying on physical, chemical, and biological parameters typically collected during the BURP process (Grafe et al. 2002). Its primary purpose is for 303(d) listing and 305(b) reporting. Once a water body is on the 303(d) list, a subbasin assessment must be completed to determine if a TMDL is necessary. Typically a subbasin assessment compiles more information about the water body(s) in question; WBAG II assessment calls are then used as part of the information to determine beneficial use status. Therefore, the subbasin assessment is the document that determines if a TMDL is necessary not the WBAG II.

WBAG II stratifies streams into segments based on stream order and land use. First and second order streams are combined; physically, chemical and biologically these streams are very similar. BURP data is used to determine the index scores (stream macrobiotic index [SMI], stream fish index [SFI], and stream habitat index [SHI]). In determining the total SMI, SFI, and SHI scores, numerous indicators and metrics are evaluated to get the total score for that index.

For example, the SHI metrics include parameters like large organic debris, percent canopy cover, embeddedness, and channel shape; SMI metrics include parameters like total number of taxa, number of mayflies, number of stoneflies, and number of caddisflies. These metrics scores are compared to a reference condition for the appropriate bioregion and given an index score (0, 1, 2, or 3). The index scores are then added and divided by three to get an average composite score for each segment. If two BURP sites are located in a stream segment, the lower of the two scores is used to interpret aquatic life support calls. If more than two sites are on a segment, they are averaged to determine an aquatic life support call. An averaged composite score of two or greater passes (full support, FS) while a score of less than two fails (not full support, NFS).

Data collected outside of DEQ can also be used to assist with determining designated beneficial use if the data is less than 5 years old and if it meets certain requirements outlined in WBAG II.

Table 2-4 displays the WBAG II results for the 303(d)-listed streams in the Palouse River Subbasin; some streams have multiple BURP sites and/or multiple years of BURP data collection. The table displays the information currently available from BURP surveys conducted in 2002. At this time (November 2004), the SFI scores are not available. The average scores without the SFI are also shown. The SFI, as is the SHI and SMI, is critical when determining beneficial use status. The WBAG II beneficial use status calls, as shown, do not directly identify pollutants and for this report were used on a limited basis to determine whether a stream required a TMDL.

**Table 2-4. WBAG II beneficial use status calls for 303(d)-listed water bodies.**

<b>Water Body (Creek)</b>	<b>Stream Macrobiotic Index (SMI)</b>	<b>Stream Fish Index (SFI)</b>	<b>Stream Habitat Index (SHI)</b>	<b>Average Score FS/NFS</b>
Big – upper	56.07 (3)	NOT AV	62 (3)	3
Big – lower	56.76 (3)	NOT AV	57 (2)	2
Deep Creek – upper	51.42 (3)	NOT AV	45 (1)	2
Deep – lower	32.59 (0)	NOT AV	30 (1)	0
Flannigan – upper	DRY	DRY	DRY	DRY
Flannigan – lower	46.21 (2)	NOT AV	34 (1)	1.5
Gold – upper	73.45 (3)	NOT AV	60 (3)	3
Gold – lower	43.56 (2)	NOT AV	34 (1)	1.5
Gold – Crane tributary	UN	UN	UN	UN
Hatter – upper	51.83 (3)	NOT AV	66 (3)	3
Hatter – lower	67.61 (3)	NOT AV	42 (1)	2
West Fork Rock – upper	DRY	DRY	DRY	DRY
West Fork Rock – lower	DRY	DRY	DRY	DRY

<sup>1</sup> FS = Full support

<sup>2</sup> DRY = Dry site at time of survey

<sup>3</sup> NFS = Not full support

<sup>4</sup> UN = Unknown

<sup>5</sup> NOT AV = Data not available

### Idaho's Cumulative Watershed Effects Process (CWE)

The Cumulative Watershed Effects (CWE) process is a watershed model that evaluates a variety of conditions, related to timber activities on the ground, to determine impacts to the environment. The CWE process is a framework for collecting and organizing data on mass failures, surface erosion hazards, stream temperature, watershed canopy conditions,

hydrologic risks, sediment production and delivery to a waterway, stream channel stability, and water nutrient conditions. The process relies on the WBAG II beneficial use support determination as the measure of whether or not a stream is water quality impaired. The CWE methodology analyzes data collected from on-the-ground conditions, and determines whether forest practices are creating “adverse conditions” due to sediment, temperature, nutrients, and/or hydrologic impacts (IDL 2000<sup>b</sup>). CWE assessments, including road data, were collected on all of the upper most portions of the watersheds of the 303(d)-listed streams.

The intent of CWE is to allow forest managers to respond to the CWA when forest practice standards are not being met. Adverse conditions are not defined using the state’s water quality standards, but these standards do allow forest managers to pinpoint the condition impacting water quality. CWE is physically conducted in the watershed, and the results are an up-to-date, systematic assessment of on-the-ground conditions. When CWE identifies an adverse condition for sediment, temperature, nutrients, or hydrologic function, managers and area foresters should investigate that particular area and determine what corrective actions are needed.

While CWE produces, in the final analysis, a pass/fail for each of the pollutant types, the CWE scores derived from the data provide a continuous-scale rating of the situation. When a CWE assessment conclusion does not agree with conclusions of the DEQ WBAG assessment or the 303(d) list, the CWE data can be analyzed to help explain the discordance and arrive at a conclusion about the status and causes of water quality problems.

CWE reports for all of the 303(d) listed streams in this subbasin are available on line at <http://www2.state.id.us/lands/bureau/forasst> or at the Deary IDL office. These reports were examined and some of the data was used. The adverse condition results and the total sediment delivery rating/scores are of particular interest and are displayed at the end of each CWE report.

The sediment delivery score gives a total score from all sources of sediment from the watershed including roads, mass failures, and trails. The ratings for sediment are *low*, *moderate*, or *high*, with *low* being a high-quality condition and *high* being a low quality condition. These results were used in this evaluation to help determine water quality impairment from adverse sediment conditions. Stream segments with high temperatures were also identified. Forest managers should take note of the management problems identified in the CWE. Correcting these management problems would be good start to improving water quality on the TMDL streams.

### Revised Universal Soil Loss Equation (RUSLE)

The Revised Universal Soil Loss Equation (RUSLE) is a set of mathematical equations that estimate average annual soil loss and sediment yield resulting from interrill and rill erosion. RUSLE reflects the evolutionary development of erosion-prediction technology. For nearly 100 years, erosion data have been collected, analyzed, presented, and discussed in the professional arenas of agricultural and civil engineers, agronomists, soil scientists, geologists, hydrologists, and geomorphologists. The breadth and depth of these scientific investigations

allow confidence in the application of RUSLE for the estimation of soil loss from mined lands, construction sites, and reclaimed lands.

RUSLE does not estimate erosion in channels or erosion from roads; it merely computes erosion from the soil surface. Derived from the theory of erosion processes, more than 10,000 plot-years of data from natural rainfall plots, and numerous rainfall-simulation plots, RUSLE is an exceptionally well-validated and documented model. A strength of RUSLE is that it was developed by a group of nationally recognized scientists and soil conservationists who had considerable experience with erosional processes. RUSLE retains the structure of its predecessor, the Universal Soil Loss Equation (USLE).

RUSLE resulted from a 1985 workshop of government agency and university soil-erosion scientists. The workshop participants concluded that the USLE should be updated to incorporate the considerable amount of erosion information that had accumulated since the publication of Agriculture Handbook 537 (in 1978) and to specifically address the application of the USLE to land uses other than agriculture. This effort resulted in the computerized technology of RUSLE.

RUSLE is expressed as follows:

$$A = R * K * LS * C * P$$

Where

A = estimated average soil loss in tons per acre per year

R = rainfall-runoff erosivity factor

K = soil erodibility factor

L = slope length factor

S = slope steepness factor

C = cover-management factor

P = support practice factor

To determine the C and P factors, land-use maps were created by DEQ for each 303(d) watershed by taking printed maps of aerial photos and driving to hilltops to determine land-use during the 2002 calendar year

### Watershed Erosion Prediction Project (WEPP)—WEPP Road

Erosion from roadways is significant in the Palouse, especially in the 303(d) watersheds. To quantify these processes, the road analysis portion of the WEPP model was performed.

WEPP is a soil erosion model that can provide estimates of soil erosion and sediment yield for specific soil, climate, ground cover, and topographic conditions. Developed by an interagency group of scientists, including the U.S. Department of Agriculture's Agriculture Research Service (ARS), Forest Service and Natural Resources Conservation Service, and the U.S. Department of Interior's Bureau of Land Management and Geological Survey, WEPP simulates the conditions that impact erosion—such as the amount of vegetation

canopy, the surface residue, and the soil water content for every day in a multiple-year run. For each day that has a precipitation event, WEPP determines whether the event is rain or snow and calculates the infiltration and runoff. If there is runoff, WEPP routes the runoff over the surface, calculating erosion or deposition rates for at least 100 points on the hill slope. It then calculates the average sediment yield from the hill slope. *WEPP:Road* is an interface to the WEPP soil erosion model that allows users to easily describe numerous road erosion conditions and quantify erosion amounts. The *WEPP:Road* template has three overland flow elements: a road, a fill slope, and a forested buffer. The WEPP model allows a hill slope to be divided into segments with similar soils and vegetation called *overland flow elements*.

Roads in the Palouse were slowly driven in order to input geographically linked (GIS) information regarding the road and erosional conditions. Information like the type of road, surface of road, ditch information, cross-drain locations, buffer types and lengths to a waterway, and fillslope information were entered onto a Global Position System device (GPS). This information was downloaded into GIS for analysis. The data is arranged to show total sediment delivered to a water body within each 303(d) watershed.

### Channel/Stream Bank Erosion

A significant amount of erosion occurs along the stream banks, and in all channels naturally erode to some degree. It is significant enough that several studies have attempted to quantify this phenomenon. For this TMDL, the National Resource Conservation Service (NRCS) field estimate procedure for channel erosion was conducted on all of the 303(d) listed streams to quantify in-stream channel erosion above natural conditions caused by anthropogenic effects. It has been proposed that a stream is in constant search of equilibrium and four forces control this equilibrium: sediment load, size of sediment particle, water quantity, and slope of stream channel (NRCS 1983). These forces can be changed by natural and/or human intrusion. The equation below was developed by the NRCS to quantify in stream erosion.

$$\text{Erosion} = \frac{(\text{Eroding Area in sq.ft}) (\text{Lateral Recession Rate in ft/yr}) (\text{Density in lbs/cubic ft})}{2000 \text{ lbs/ton}}$$

Several sites were evaluated for each 303(d)-listed stream. Sites were selected based primarily on riparian and stream banks conditions and accessibility. Some sites that have significant amounts of erosion were not sampled because DEQ was not able to obtain access.

In general, the riparian areas along the entire length of each 303(d)-listed stream were grouped together based on their condition-good, fair or poor. This judgment was used to describe the riparian and stream bank conditions for the entire stream. This very basic approach revealed that riparian areas with *good* conditions have no measurable amount of erosion above background, while *fair* areas have minimal amount of erosion above background, and *poor* areas have significant amounts of erosion above background. Therefore, an attempt was made to sample the fair and poor reaches.

The reach samples sites are shown on Map D-2 (Appendix D). Although not directly part of the TMDL, this information can be used as a starting and reference site for the future after project implementation has begun.

At each site, sampled distances, stream widths, sinuosity, streambed particle size, canopy observations, were recorded. In addition, a stream erosion condition inventory was also completed. The stream erosion condition inventory describes bank erosion evidence, bank stability condition, bank cover/vegetation, lateral channel stability, channel bottom stability, and in-channel deposition. The inventory was used to help determine the lateral recession rate. The total amount of sediment eroded from each reach was calculated using the above equation, based on the field data (see Table D-3, Appendix D).

### Stream Temperature Data

Continuous temperature data came from the 2001-2002 monitoring effort by DEQ and IAWSCD. In the spring of 2002, continuous temperature data logger probes were placed in all the 303(d)-listed streams at monitoring sites PR-11, PR 5, PR-9, PR-12, PR-14, and PR-16. (Appendix A). These temperature loggers recorded temperatures every hour for each 24-hour period. The probes were removed in the late fall of 2002.

Most streams exceeded the salmonid spawning standard and all streams exceeded the cold water aquatic life temperature standard for significant periods during the summer months. A graphical display and discussion of each temperature logger data are shown later in this section (see Subwatershed Characteristics, page 52).

Instantaneous stream temperatures have been taken by numerous sources, including but not limited to, DEQ BURP crews, contractors hired by the CNF, USGS, and (during the 2001-2002 monitoring effort), by DEQ and IASWCD. The CNF has continuous temperature logger data for non-303 (d) streams on the forested sections of the Palouse watershed but this data is not included in this report. A more thorough discussion regarding temperature is located in Chapter 5.

### Fish Data

Table 2-5, based on data obtained from DEQ, IDFG, CNF, the St. Joe National Forest, and Potlatch Corporation, summarizes the fish data for the 303(d)-listed streams and some other major tributaries in the Palouse River Subbasin, displaying age classes of salmonids, as well as the total number present. Total numbers of non-salmonid species are shown as well. The table also notes when young of the year were observed, an indicator that successful spawning and rearing occur in the stream. Age class determination was based on information in the CNF surveys, which indicated the determination was made by the CNF fish biologist. This data demonstrates whether the water quality of each water body provides protection, maintenance, and propagation of a salmonid fish population.

## Flow data

Flow data for the 303(d)-listed stream primarily came from the DEQ-LRO-IASCD monitoring effort. The USGS maintains a continuous flow gage on the mainstem Palouse River, near the town of Potlatch. The CNF has a continuous flow on the Palouse River in the upper part of the Palouse River Subbasin. As part of the DEQ-LRO-IASCD monitoring effort, staff gauges were placed at some monitoring sites.

All of the staff gauges were placed at a bridge and were compared to the actual flows taken in the field. Flow measurements were collected by wading and using a Marsh McBirney flow meter for all the sites. The six-tenth-depth method (0.6 of the total depth below water surface) was used when the depth of water was less than or equal to three feet. For depths greater than three feet, the two-point method (0.2 and 0.8 of the total depth below the water surface) was used to determine stream discharge. At each sampling station, a transect line was established across the width of the creek at an angle perpendicular to the flow. The mid-section method was used to compute cross-sectional area and the velocity-area method was used to determine discharge. The discharge was computed by summing the products of the partial areas (partial sections) of the flow cross-sections and the average velocities for each of those sections. Together, cross-sections and average velocities were used to calculate cubic feet per second at each of the monitoring stations.

In some instances, the field crew was unable to access a site because of snow, and on other occasions high flows prevented them from collecting a flow measurement. At the sites with staff gauges, the flows were estimated using calculations comparing the gauge height with the actual flow or by comparing flow data and data trends in neighboring watershed on the dates with incomplete flow data. At the other sites, flows were estimated based on the other monitoring sites in that particular sub-watershed.

**Table 2-5. Fish Data for the Palouse River Subbasin.**

Water Body (Creek)	BURP Data 1996	BURP Data 2002	CNF	Other
Big – upper	RB-2+j(2), D(4), SC(45)	D(31), RS (36), SC(14)	SC(13) D(18)	CT-(UN) <sup>b</sup> BT-(UN) <sup>b</sup> RB 1(1), SC (14)- <sup>c</sup>
Big – lower	D(59), RS (16), SC(12)	D(49), RS (9), SC(4)		
Deep Creek – east fork	Dry	D(20), RS (2)	ND	ND
Deep – middle fork	Dry	D(35), RS (48)	ND	ND
Deep – lower	D(259), RS (180), PS(2), SQ(17), SU(16)	UN	ND	ND
Flannigan – upper	RB-2+j(3), D(48), RS (3) SC(45)	Dry	ND	ND
Flannigan – lower	D(290), SU (13), NPM(22)	UN	ND	ND
Gold – upper	RB-3+j(13)	RB-3+j(12)	RB-3+j(UN) ND	
Gold – lower	D(529), RS(66) CF (2)	RS(29), SU(2), NPM(17), D(23)	ND	ND
Gold – Crane tributary	BT-1+j(16), SC(5)	UN	ND	ND
Hatter – upper	RB-1+j(2), BT-1+j(2), SC(6)	BT-2+j(3), SC(1)	ND	ND
Hatter – lower	D(126), RS(24), SC (11)	RB-3+j(6), D(8), RS(14), SU(3) SC(6)	ND	ND
West Fork Rock – upper	Dry	Dry	ND	ND
West Fork Rock – lower	Dry	Dry	ND	ND
Palouse River-middle	RB-3+j(15), BT 2+j(4)	UN	BT 3+j(16), SC-(UN)	CT-(UN) <sup>b</sup>
Palouse River-upper	RB-1(1), BT 3+j(12)			BT-(UN) <sup>b</sup>

CT-Cutthroat

RB-Rainbow

BT-Brook Trout

D-Dace-total

PS-Pumpkin Seed

RS-Redside Shiner

S-Shiner-non-species specific

NPM-Northern Pike Minnow

SU-Sucker

SC-Sculpin-total numbers only-non species specific

( )-Total number of fish

UN-Unknown

CF-Crawfish

#+j-number of ages classes including young-of-the-year juvenile

<sup>a</sup> No data<sup>b</sup> St Joe National-1938<sup>c</sup> 1998 Potlatch Corporation data

(Last Chance Cr. T41N, R3W, sec 16)

### Clearwater National Forest Service Contracted Services

The CNF contracted comprehensive surveys for many streams. Isabella Wildlife Works performed field work in the summer of 1998 on the Palouse River and several other tributaries on the CNF. This study included a survey of the whole stream divided into numerous reaches, surveys and calculations of substrate embeddedness, riffle stability, fish and stream flow calculations. These surveys included Rosgen channel types and major hydrologic features determination. The physical and hydrological data is fairly extensive and thorough. Fish surveys performed in these reports are typically performed by snorkeling. A survey was performed in the Gold Creek and Big Creek watersheds. The results are shown in Table 2-5.

Gradient, bank stability index, length of raw banks, width and depth, percent pools, and acting and potential woody debris were some of the indicators selected out of those reports to help assess sediment conditions. These measures were used to assess the level of water quality impairment. For example, length of raw banks, and bank stability were looked at as an indicator of in-stream erosion. Acting and potential woody debris tell a lot about fish habitat and canopy cover for each stream, while percent pools, gradient, and width and depths are important habitat parameters to evaluate over an extended period of time. Collectively this data was used to help determine the level of water quality impairment and beneficial use status. Data from these reports was not used directly for beneficial use determination in this report, but for background physical and biological information for the upper portion of the Palouse River Subbasin.

## **2.4 Subwatershed Characteristics**

This section determines which water bodies are water quality limited by a pollutant, and hence will need a TMDL, and which water bodies are not water quality limited. The physical, chemical and biological parameters and associated data are shown within the tables and figures and are described within this section to help determine beneficial use status of the 303(d)-listed water bodies. Recommended additions to the 303(d) list are also included in this section.

### Big Creek

Big Creek is 303(d)-listed for sediment; the boundaries are defined as headwaters to Palouse River. The designated beneficial uses for Big Creek include salmonid spawning, cold water aquatic life, and secondary contact recreation. Big Creek is a third order stream at its confluence with the Palouse River and the headwaters originate off the east side of Gold Hill and Prospect Peak. The entire basin is shown on Map 2-1.

The Big Creek Watershed is 16.11 square miles in size (10,311 acres). Most of the land in Big Creek is owned and managed by Potlatch Corporation. The uppermost headwaters are managed by the CNF. The lower mile and a half is under private land ownership. The state of Idaho also manages a few small portions within the watershed.

The primary land uses in the watershed are forestry, grazing, and recreational activities. Some non-cultivated croplands are present in the very lowest portion of the watershed. Big Creek generally flows from the northwest to the southeast, and the basic drainage pattern could be described as dendritic. Elevations range from 2,611 feet to 4,138 feet. The geology of the watershed is highly weathered metasediments with some areas of highly weathered granitics. The valley bottom of the lower main stem Big Creek and tributaries are underlain by coarse textured alluvium.

Several major tributaries flow into Big Creek within the forested areas. Big Creek and most of its largest tributaries are perennial streams. Some of these tributaries are classified as intermittent by the USGS quad map. For example, the upper monitoring site (PR-10a) was on a tributary classified as intermittent, and it went dry (below five cubic feet per second) in early May and dry in mid-July. The lower site is about a half-mile from the mouth and had perennial flows. So the stream classification by the USGS matched the data collected for this TMDL.

During the winter the upper sites (PR-10a, and PR-10b) were inaccessible from mid January through the first part of April due to snow. The lower site (PR-11) was accessible all year.

Monitoring was performed from November 2001 through mid January 2002 at PR-10a. Deep snow prevented monitoring at PR-10a from January 2002 through early April 2002. Monitoring resumed in early April 2002 through mid July 2002 at PR-10a. In the summer the monitored crew realized this site was on an intermittent stream called Lost Creek, a tributary to Big Creek. From July 2001 through September 2001 site PR-10a remained dry, and no data was collected at PR-10a. A decision to move the site was made by the collaborators of the monitoring plan in September 2002. A new site on a perennial section of Big Creek was located and established in September 2002. Monitoring at this new site (PR-10b), which represents the upper portion of the Big Creek watershed, resumed near the end of September 2001 and continued through November 2002.

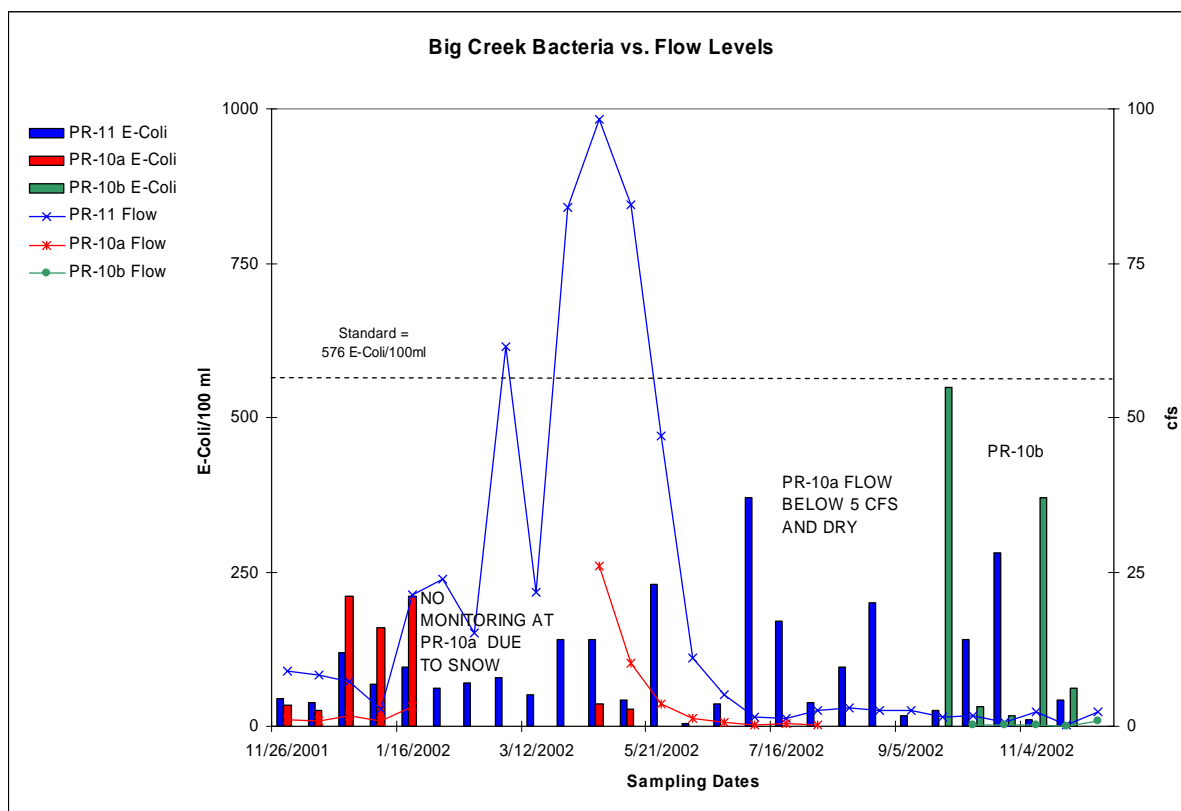
The locations of these sites are identified on Map 2-1. Fish information for Big Creek is displayed in Table 2-5. Rainbow trout and sculpin have been observed in the upper Big Creek and in Last Chance Creek. Big Creek has the fewest anthropogenic impacts of all the 303(d) streams in the Palouse River Subbasin.

### Status of beneficial uses

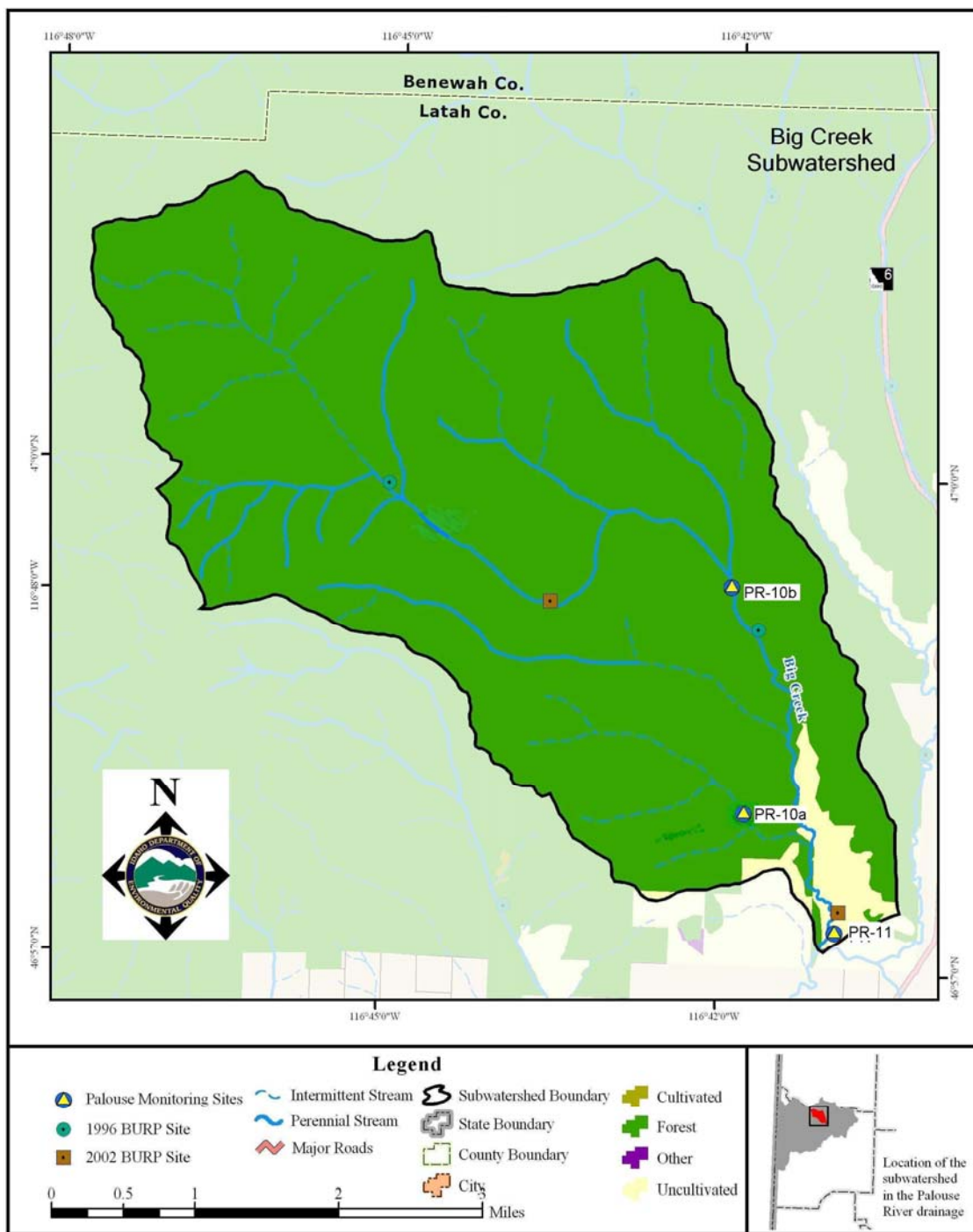
Results from the 2001-2002 field season are displayed in Figures 2-1 through 2-7. Beneficial uses are being impaired by temperature in Big Creek. DEQ recommends that Big Creek be de-listed for sediment, bacteria and nutrients.

No violations of a state bacteria standard occurred within the Big Creek watershed from November 2001 through November 2002. Some e-coli was present but at levels below the standard. Limited cattle grazing does occur with this watershed, however, the secondary

contact recreational beneficial use standard was never violated. Based on this data DEQ recommends that Big Creek be de-listed for bacteria.



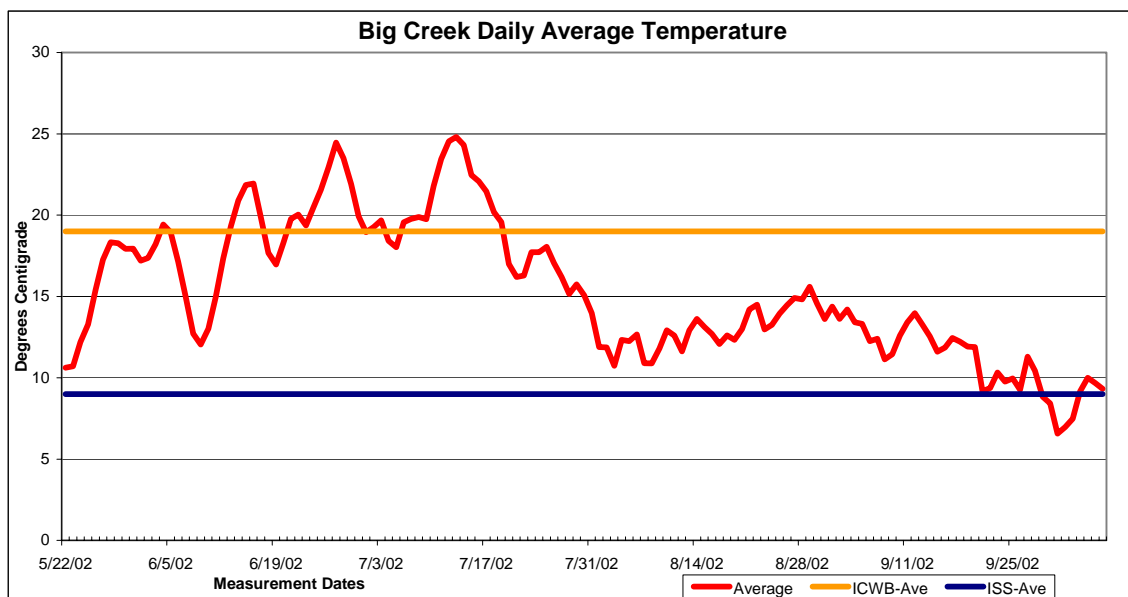
**Figure 2-1. Big Creek Bacteria Levels**



**Map 2-1. Big Creek Subwatershed**

A continuous temperature data-logger probe was placed near the lower monitoring site of Big Creek. The probe recorded temperature readings every hour from mid-May 2002 through early October 2002. The results are display in Figure 2-2. During this period, temperatures exceeded the Idaho cold water aquatic life daily average (ICWB-Ave) of 19°C, and the Idaho

salmonid spawning daily average (ISS-Ave) of 9° C. Based on this information, a temperature TMDL will be developed for Big Creek.



**Figure 2-2. Big Creek Temperature**

The nutrient data are displayed in Figures 2-3 through 2-5 and Table 2-6. Total nitrogen (NO<sub>2</sub>+NO<sub>3</sub>) levels were at or below the minimum detection limit of 0.1 mg/L for the entire monitoring season. Ammonia levels were at the minimum detection limit except for two very small increases at the lower site. A target of 0.10 mg/L for total phosphorus (TP) and a dissolved oxygen level below 6.0 mg/L during the growing season (May-October) was established for this TMDL.

The nutrient target is based on the numeric state standard for dissolved oxygen requiring level to be greater than 6.0 mg/L at all times, and a narrative target stating that surface waters shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses.

The monitoring site in lower Big Creek (PR-11) violated the DO standard on two occasions in July when measured flow was about 2.5 cfs, however, this monitoring site becomes more of a stagnant pool during low flows. The gradient is flat and there is no visible water moving but flow was measured anyway. Later in the season, when flows were lower and when temperatures were cooler, the DO levels were above 6.0 mg/L.

Table 2-6 displays the TP, DO and flow for both sites. Additionally, table 2-6 displays the time and instantaneous temperature for the lower monitoring site (PR-11). On the July 16<sup>th</sup> and July 29<sup>th</sup> 2001 dates the instantaneous temperatures at 0930 and 0900 (typically the coolest time in a stream) were 17.9 and 16.6° C. Continuous temperature data showed that temperature rose to over 25° C on the same day in Big Creek. DEQ believes the high

temperature, low gradient condition of the lower monitoring site was the cause of the DO exceedances, not nuisance algae.

Based on sites visits and field crew reports there is not a nuisance aquatic growth problem in Big Creek. Big Creek has minimal anthropogenic impacts and very few nutrient sources. The single TP violation was one tenth above the target set for these nutrient TMDLs and occurred once, on 6/18/02, when the DO reading was 6.74 mg/L.

Table 2-4 displays the WBAG II assessments, which show that Big Creek, is meeting beneficial uses. If the data in Table 2-4 was the only information available for Big Creek, Big Creek would be removed from the 303(d) list for sediment, bacteria, and nutrients as it shows it is meeting beneficial uses.

A TMDL for temperature will be written for Big Creek. The implementation plan should focus on some of the some possible remedies which would be increasing shade and limiting livestock access to the stream. These were thought to have some effect on the low DO readings in Big Creek. In conclusion, because of the absence of nuisance algae, good overall condition of the watershed with few anthropogenic impacts, the infrequent occasion of the DO exceedances, and the one TP exceedance just barely over 0.1 mg/L, WAG input, the temperature TMDL, and DEQ best professional judgment, DEQ recommends that Big Creek be de-listed for nutrients.

**Table 2-6. Big Creek TP and DO Monitoring Results during growing season**

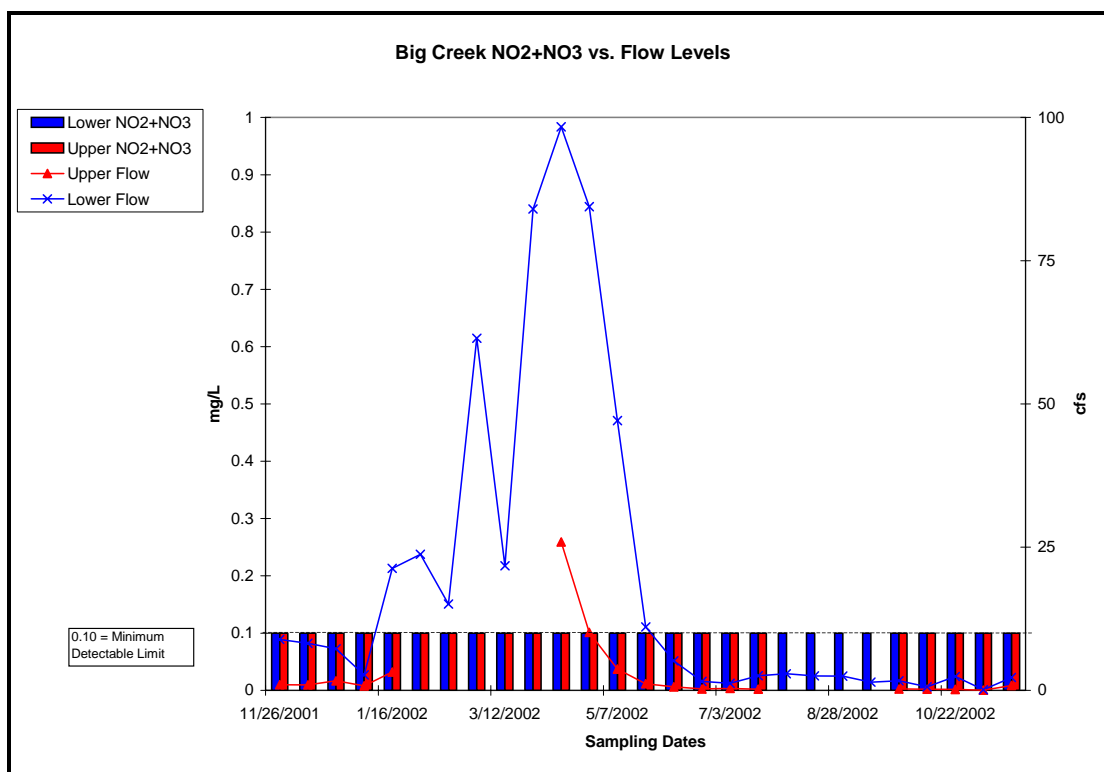
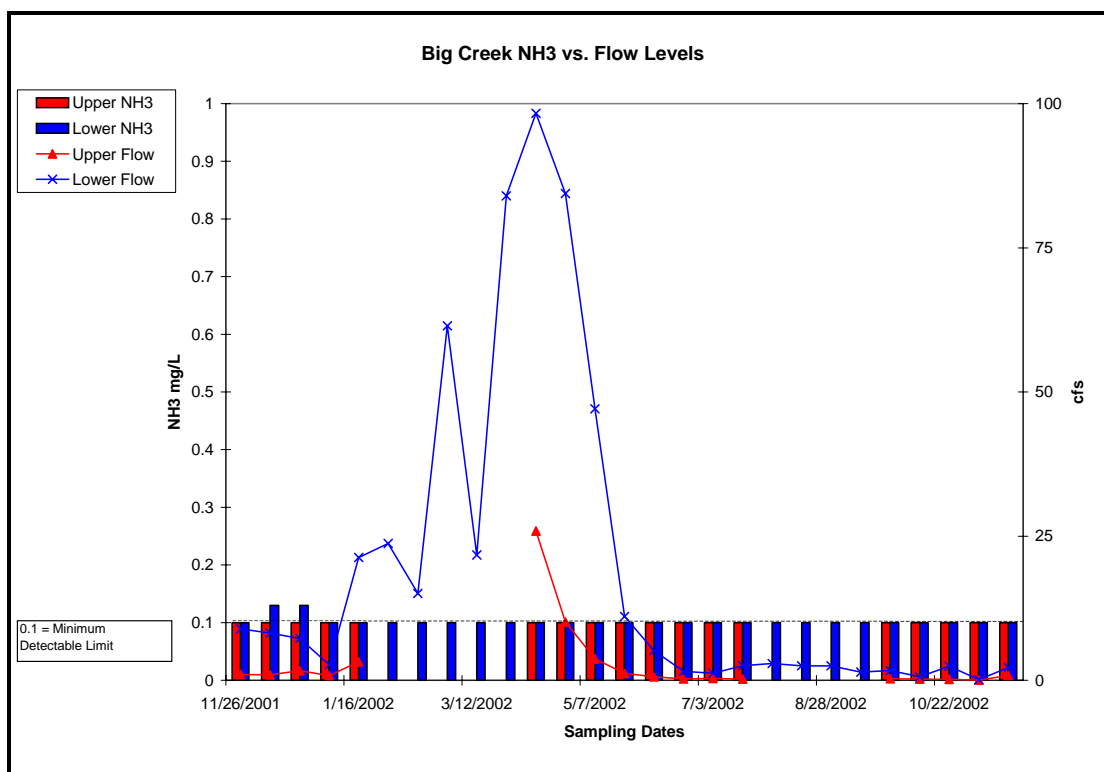
Date	PR-11 (TP) <sup>1</sup>	PR-11 (DO) <sup>1</sup>	PR-11 Time <sup>2</sup>	PR-11 Temp <sup>3</sup>	PR-11 (discharge) <sup>4</sup>	PR-10 (TP) <sup>1</sup>	PR-10 (DO) <sup>1</sup>	PR-10 (discharge) <sup>4</sup>
5/7/2002	0.02	11.85	1015	3.60	47.10	0.04	12.13	3.72
5/21/2002	0.04	8.06	1000	8.70	11.07	0.05	9.69	1.17
6/4/2002	0.04	8.29	1420	15.40	5.14	cfs<1	cfs<1	cfs<1
<b>6/18/2002</b>	0.11	6.74	1515	17.90	1.56	cfs<1	cfs<1	cfs<1
7/3/2002	0.06	6.57	900	13.40	1.22	cfs<1	cfs<1	cfs<1
<b>7/16/2002</b>	0.08	4.30	930	17.90	2.54	cfs<1	cfs<1	cfs<1
<b>7/29/2002</b>	0.09	4.78	900	16.60	2.90	DRY	DRY	DRY
8/18/2002	0.08	6.64	900	15.00	2.51	DRY	DRY	DRY
8/28/2002	0.07	6.39	830	14.00	2.50	DRY	DRY	DRY
9/5/2002	0.09	6.21	940	13.30	1.43	DRY	DRY	DRY
9/24/2002	0.09	7.54	1100	7.90	1.68	cfs<1	cfs<1	cfs<1

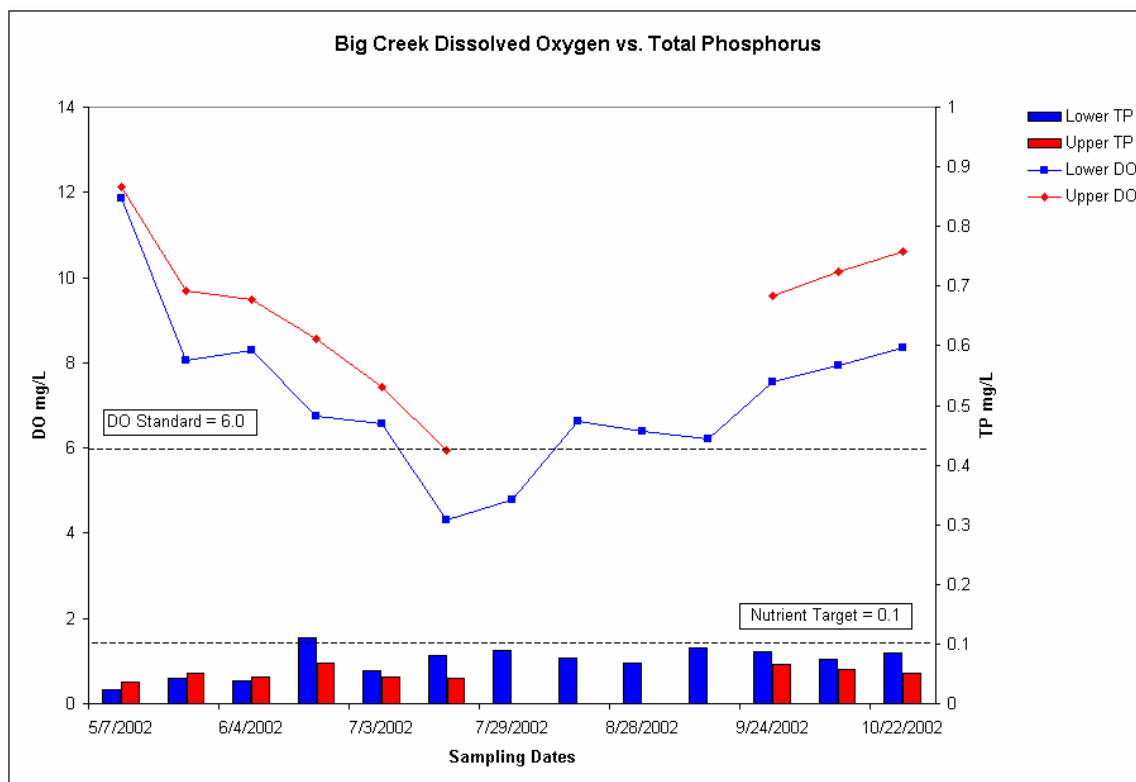
<sup>1</sup> mg/L

<sup>2</sup> 24 hour clock

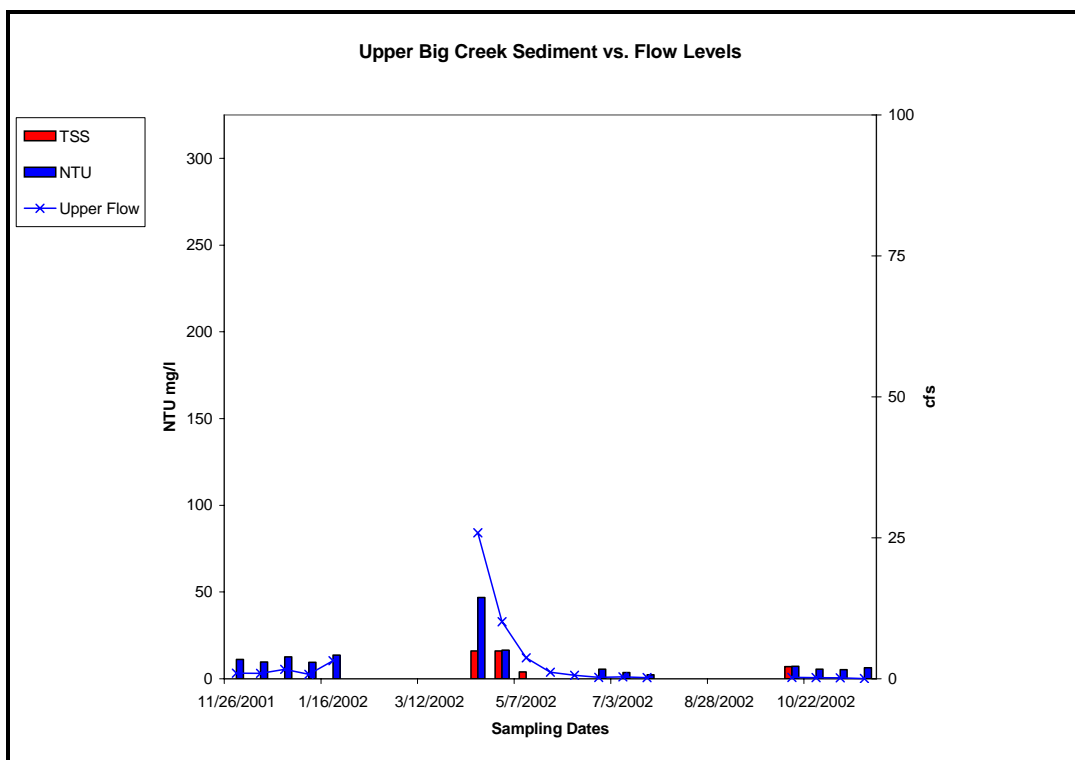
<sup>3</sup> °C

<sup>4</sup> cfs

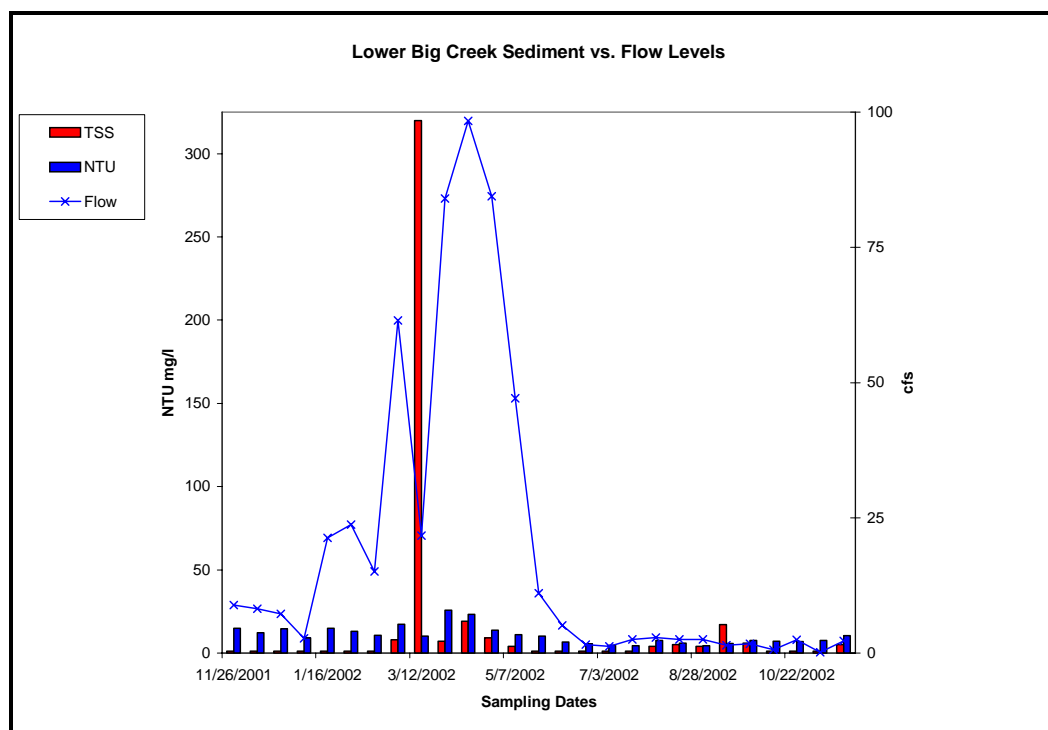
**Figure 2-3. Big Creek Total Nitrogen (NO<sub>2</sub> + NO<sub>3</sub>) Levels****Figure 2-4. Big Creek Ammonia (NH<sub>3</sub>) Levels**



**Figure 2-5. Big Creek DO versus Phosphorus (TP) Levels**



**Figure 2-6. Big Creek-Upper- Sediment Levels.**



**Figure 2-7. Big Creek-Lower- Sediment Levels**

Total suspended solids (TSS), expressed in mg/L, turbidity expressed in nephelometric turbidity units (NTU), and discharge expressed in cubic feet per second (cfs), for the upper and lower monitoring sites, are displayed in Figures 2-6 through 2-7.

TSS is a weighted measure of the total solid concentrations in the water, whether the particles are mineral (such as soil particles) or organic (such as plants). An NTU is a measure of turbidity based on a comparison of the intensity of the light scattered by the sample under defined conditions with the intensity of the light scattered by a standard reference suspension under the same conditions. These two measures are the standard indicators for sediment level concentration in surface water applications nationwide. Idaho State Standards for sediment state that sediment levels shall not impair designated beneficial uses and that turbidity shall not exceed background turbidity by more than 50 NTU instantaneously or more than 25 NTU for more than ten consecutive days.

Figures 2-6 and 2-7 display data that was collected approximately every two weeks, for the period November 2001-November 2002. To determine if sediment levels were above state standards and impairing beneficial uses, additional calculations and assumptions were made. First, a more thorough discharge profile for Big Creek was developed. This profile is based on ten years of data collected at the USGS Palouse River gage site, watershed size differences between Big Creek and the Palouse River, and in-stream flows collected for Big Creek during November 2001-November 2002.

The data shown displays numeric relationships between discharge and NTU, discharge and TSS, and NTU and TSS. These relationships can be expressed as mathematical equations,

called regression equations. The regression equations used to calculate values for TSS, NTU, background TSS, background NTU and TSS levels over background are located in Appendix B.

Based on the sediment data collected, the mathematical relationships established in this TMDL there are no sediment loads over background therefore DEQ recommends that Big Creek be removed for sediment.

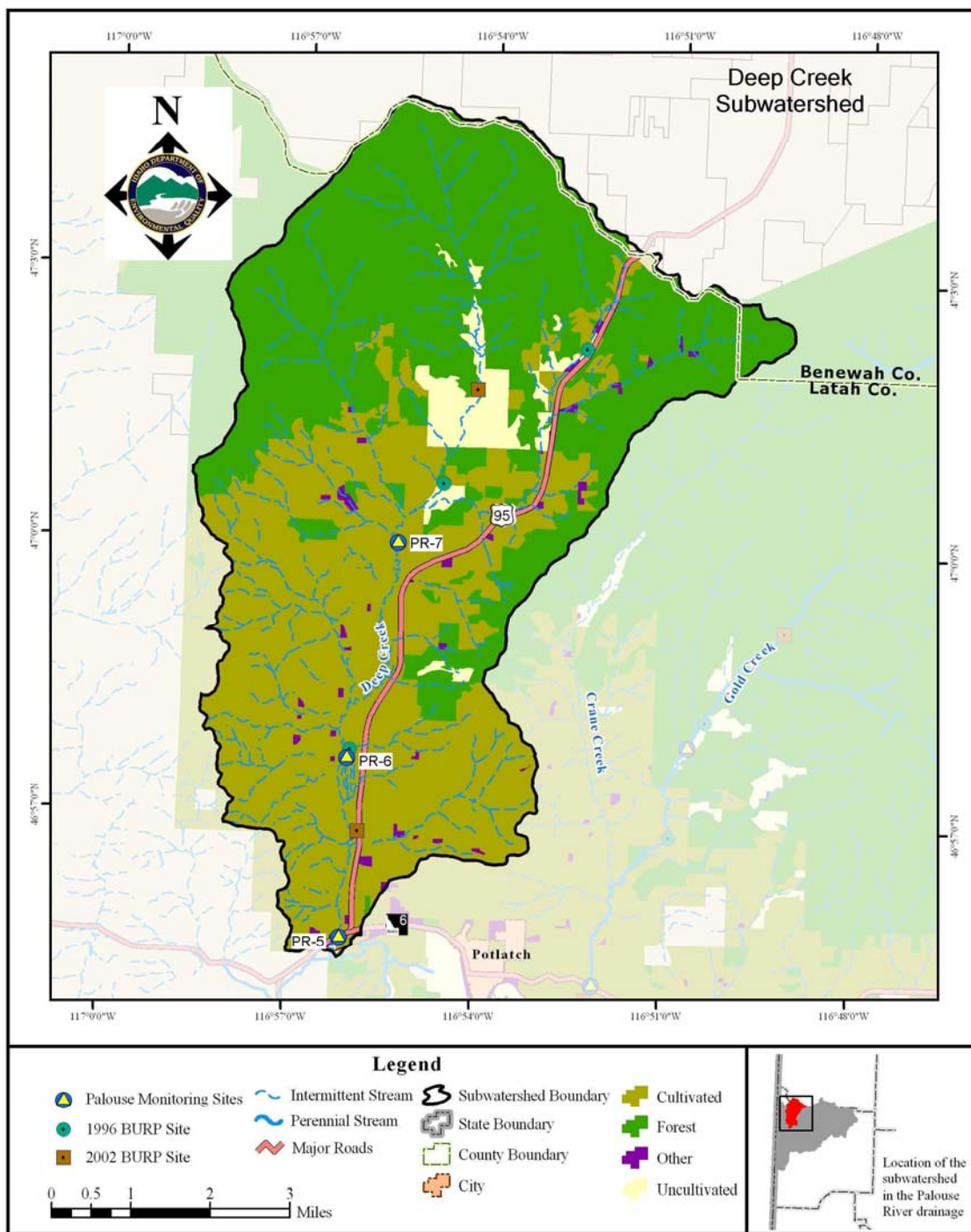
### Deep Creek

Deep Creek is 303(d)-listed for sediment, temperature, nutrients and bacteria. The boundaries are defined as headwaters to Palouse River. Deep Creek beneficial uses include cold water aquatic life and secondary contact recreation.

Deep Creek is a fourth order stream at its confluence with Palouse River. The headwaters originate off the south side of Mission and Mineral Mountains. The entire basin is shown on Map 2-2.

The Deep Creek Watershed is 42.75 square miles in size (27,357 acres). Most of the land in Deep Creek is under private land ownership although the uppermost portion has some IDL, CNF and Bennett Lumber ownership. McCroskey State Park, a 5,300 acre state park is located along the Mission and Mineral Mountain ridgeline. Deep Creek generally flows from the north to the south and the basic drainage pattern could be described as dendritic.

Elevations range from 2,483 feet to 4,320 feet. The geology of the upper watershed and upper elevations are of weathered metasediments with a few granite outcrops along the ridgeline. Palouse Loess is the dominant surface geology in the mid to lower elevations. Basalt outcroppings underlay the Palouse Loess in the lower half of the watershed, and in the valley bottoms along the main stem Deep Creek, coarse textured alluvium is present.



**Map 2-2. Deep Creek Subwatershed**

Three major tributaries of Deep Creek—the *west*, the *middle*, and the *east* forks—come together around the forest to agriculture interface. Just downstream from there is the upper monitoring site (PR-7). Between the upper (PR-7) and middle site (PR-6), agriculture and grazing are the major land uses. Between the middle (PR-6) and mouth site (PR-5), several

homes are located within the extended floodplain of Deep Creek. The major land uses along this stretch are agriculture, grazing, and some residential homes. State highway 95 also parallels Deep Creek for several miles in the lower and middle portions of the watershed.

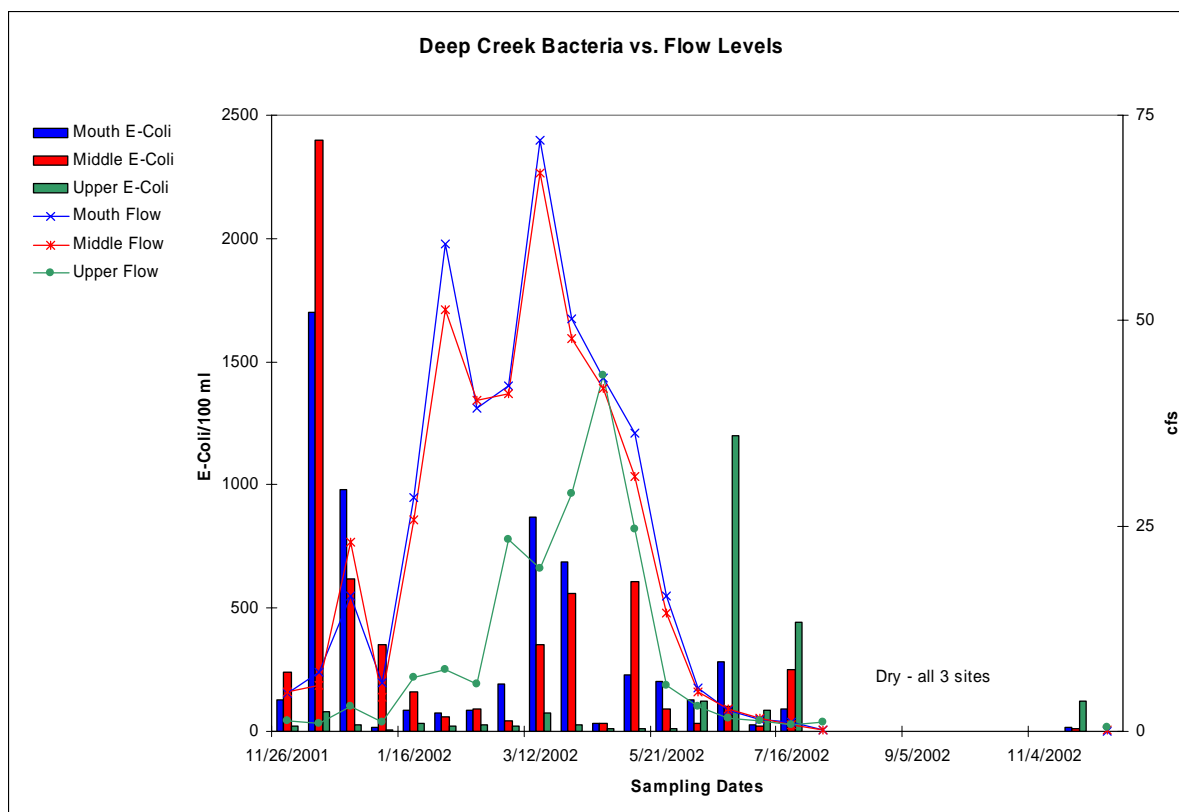
The USGS quad map and field data collected for this TMDL indicate that Deep Creek is an intermittent stream.. All three sites on Deep Creek were completely dry from the later half of July through October 2002. In early August 1996, the east and middle fork of Deep Creek were dry. In 2003, the middle-monitoring site was dry in July and August.

IDAPA 58.01.02.070.06 states, “numeric standards only apply to intermittent waters during optimum flow periods sufficient to support the uses for which the water body is designated. For recreation, the optimum flow is equal to or greater than five cfs. For aquatic life uses, optimum flow is equal to or greater than 1 cfs.” The data collected for Deep Creek was analyzed with the intermittent stream use classifications. The current fish data that has been collected in the lower section of Deep Creek supports a seasonal cold water fishery rather than cold water aquatic life; dace, red-side shiners, suckers, and the north pike minnow are the species present. Although not document by DEQ the upper tributaries probably support a cold water aquatic life fishery with pockets of salmonids and sculpin.

#### Status of beneficial uses

Results from the 2001-2002 field season are displayed in Figures 2-8 through 2-16. Sediment, temperature, nutrients, and bacteria in Deep Creek are impairing beneficial uses. For reasons described in the following, sediment, temperature, nutrient, and bacteria TMDLs are required.

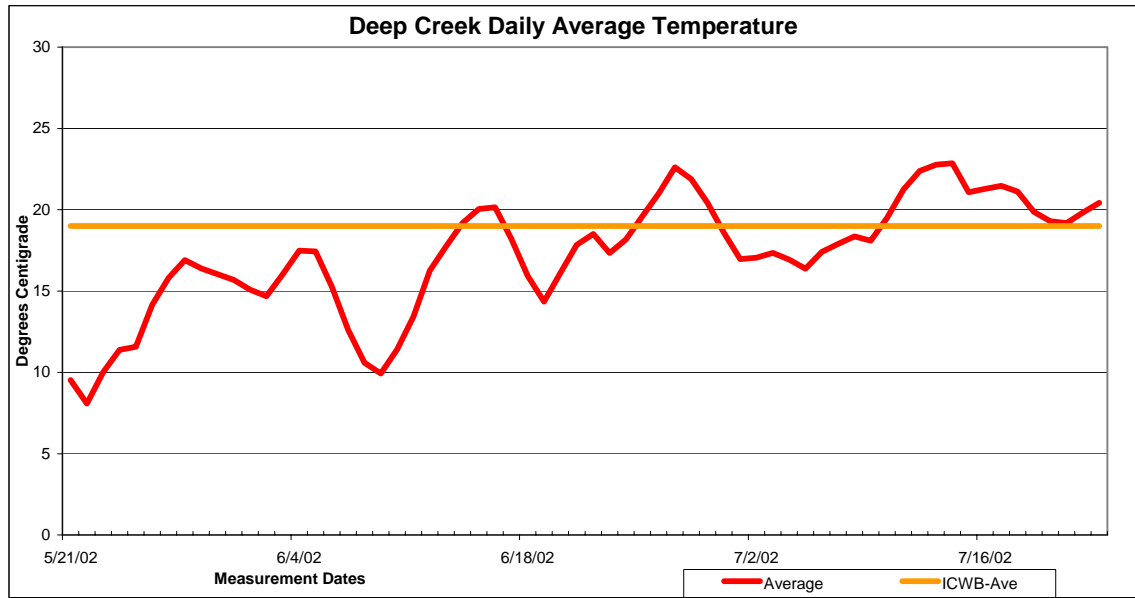
Bacteria data displayed in Figure 2-8 indicate several exceedances of the state bacteria standard for secondary contact recreation. The lower two sites exceeded this value several times during the 2001-2002 monitoring season, even when flows were greater than 5 cfs. The upper site exceeded the instantaneous standard once when flows were less than 5 cfs. Based on these exceedances, Deep Creek is water quality impaired by bacteria; therefore, a bacteria TMDL will be written for Deep Creek.



**Figure 2-8. Deep Creek Bacteria Levels**

A continuous temperature data-logger probe was placed near the middle-monitoring site (PR-6) of Deep Creek. The probe recorded temperature readings every hour from mid-May 2002 to late July 2002. Deep Creek is an intermittent stream and went dry in late July 2002.

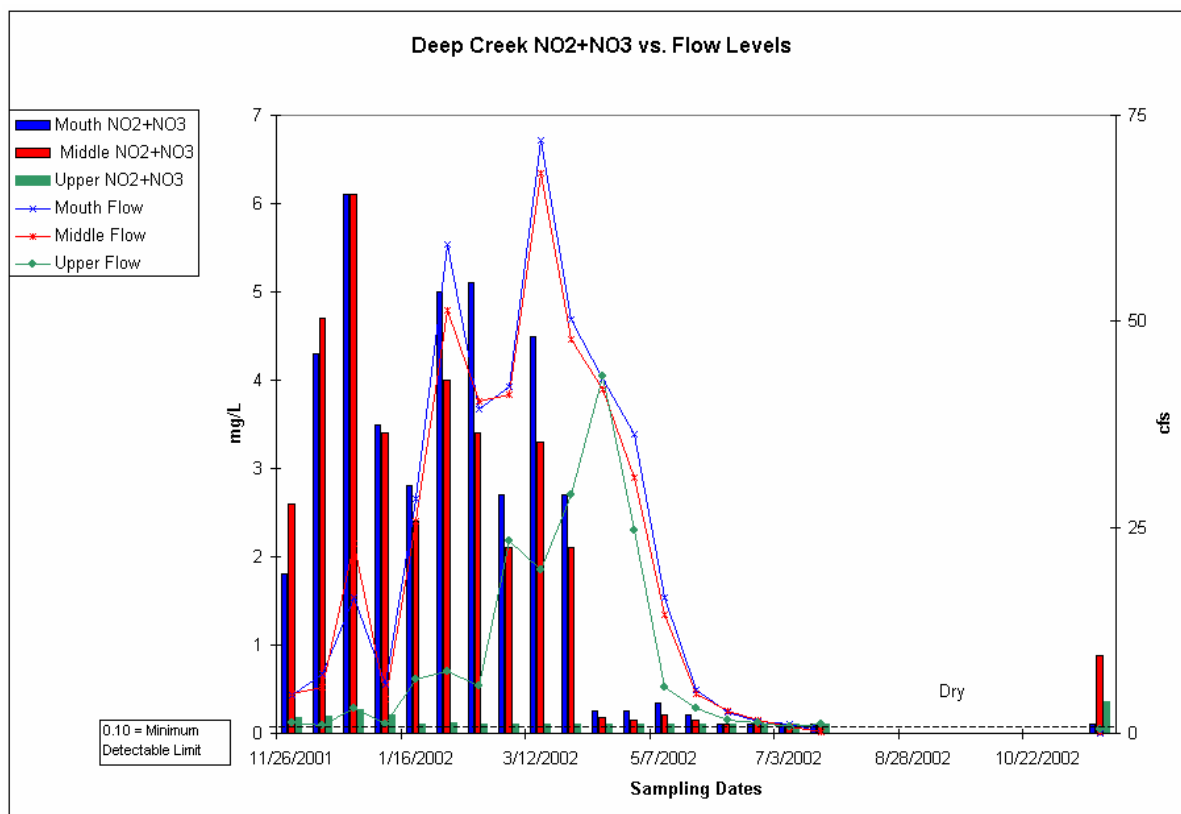
Figure 2-9 displays the results of Deep Creek only when discharges were greater than one cfs. During this period, temperatures exceed the Idaho cold water aquatic life daily average (ICWB-Ave) of 19°C. No salmonids are present in Deep Creek; therefore, the Idaho salmonid spawning daily average (ISS-Ave) of 9°C does not apply. Deep Creek monitoring resumed with measurable flows in mid November 2002 when measured instantaneous temperatures were well below the ICWB-Ave. Based on this information a temperature TMDL will be developed for Deep Creek during when flows are greater than 1 cfs and above the ICWB-average.



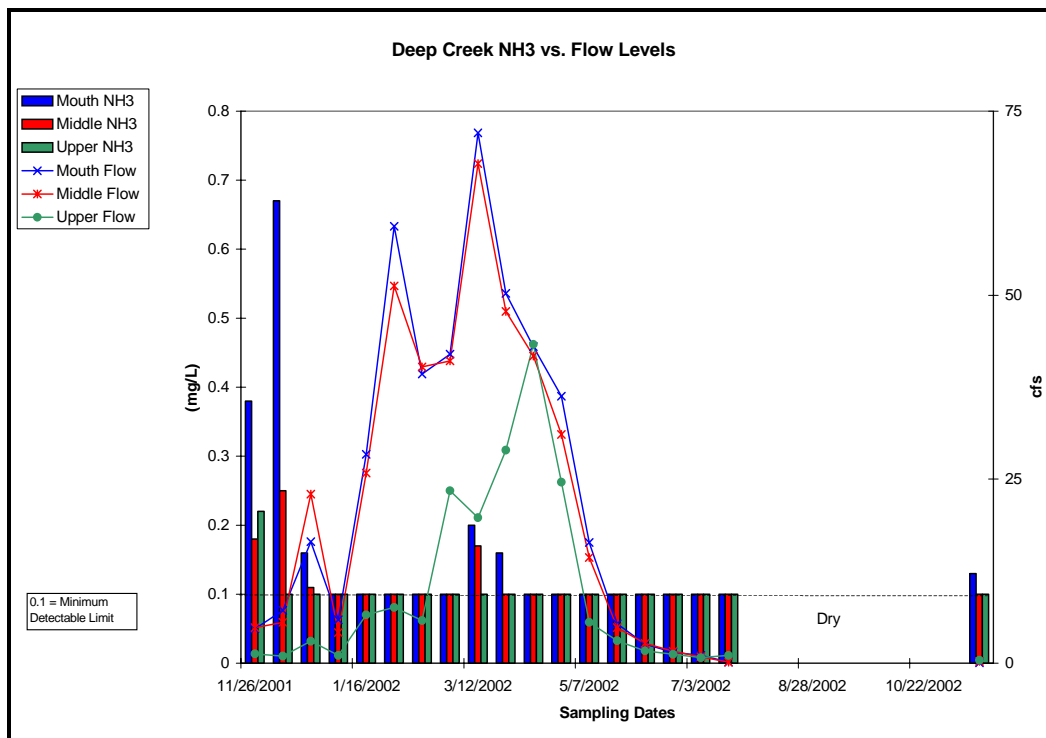
**Figure 2-9. Deep Creek Temperature**

The nutrient data are displayed in Figures 2-10 through 2-12. DEQ recommends that Deep Creek be de-listed for nutrients. A target of 0.10 mg/L TP and/or a dissolved oxygen level below 6.0 mg/L during the growing season was established for this TMDL. The nutrient target is based on a numeric state standard for dissolved oxygen to be greater than 6.0 mg/L at all times and a narrative target stating that surface waters shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses.

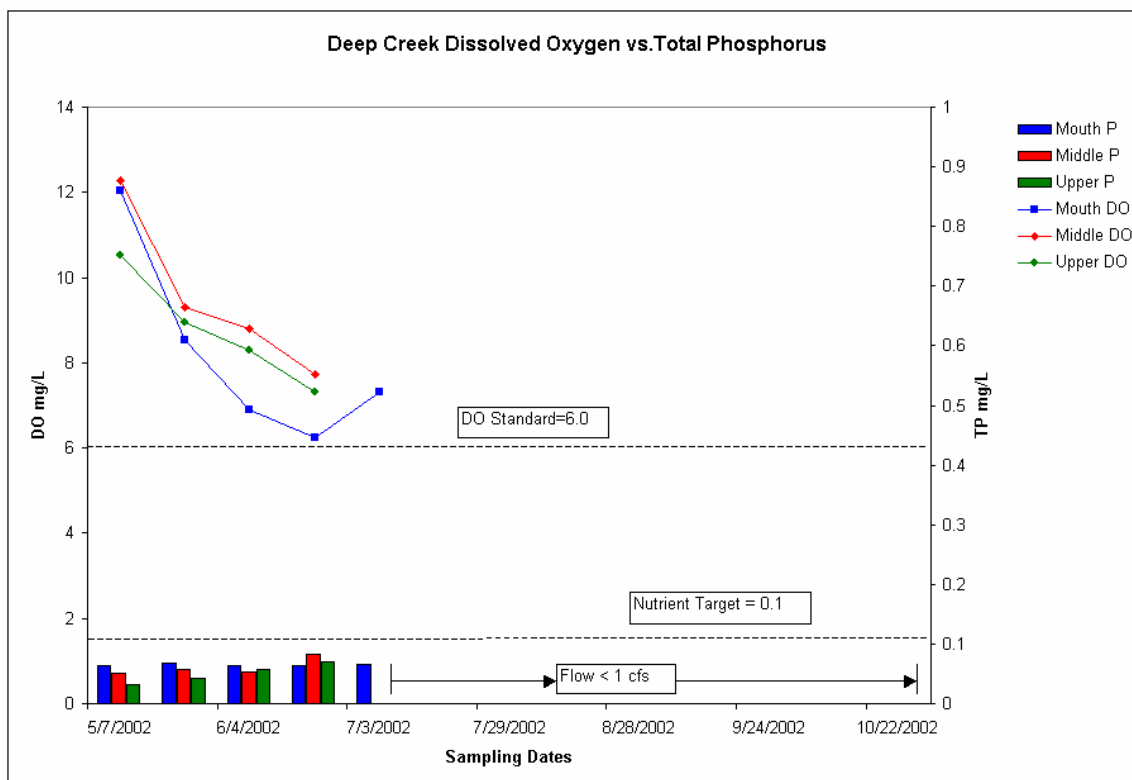
Due to Deep Creek's intermittent classification, there were no DO or TP violations when flows were greater than 1 cfs. Deep Creek probably does have some nutrient sources; these included septic systems close to the stream, cattle feeding operations and agricultural uses, but the DO oxygen standard was only violated after flows dropped below 1 cfs. Total nitrogen (NO<sub>2</sub>+NO<sub>3</sub>) and ammonia levels are somewhat elevated but within surface water guidelines. Ammonia levels are elevated on the lower two sites during the winter and spring months but are well within state standards. In conclusion, DEQ recommends that Deep Creek be de-listed for nutrients.



**Figure 2-10. Deep Creek Total Nitrogen Levels**

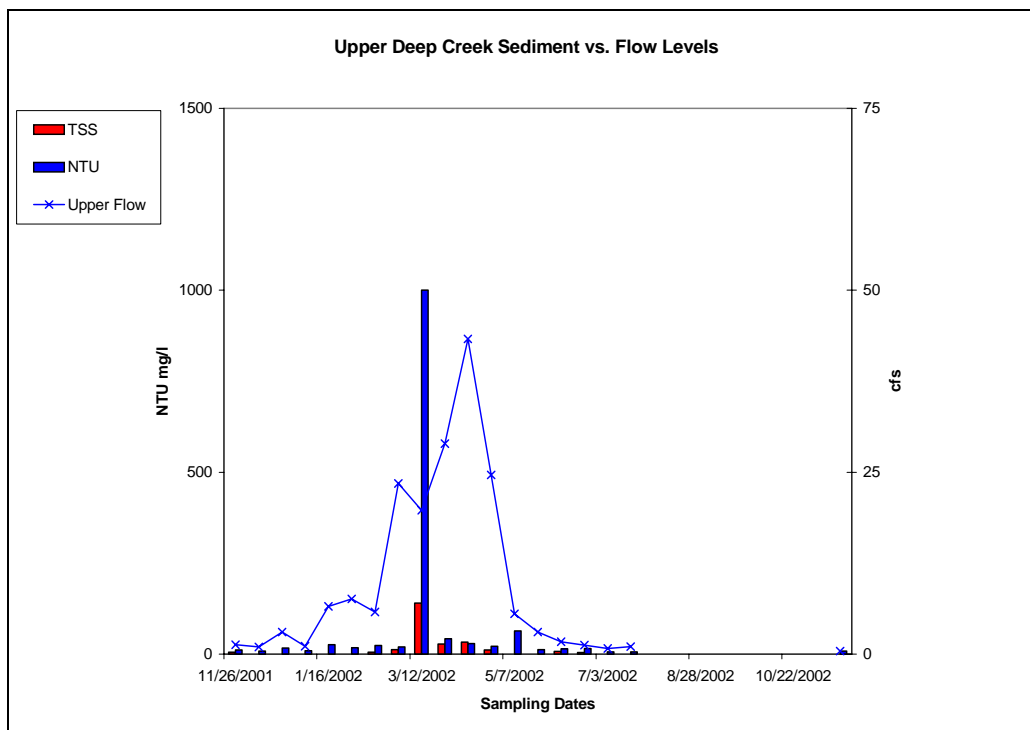


**Figure 2-11. Deep Creek Ammonia Levels**

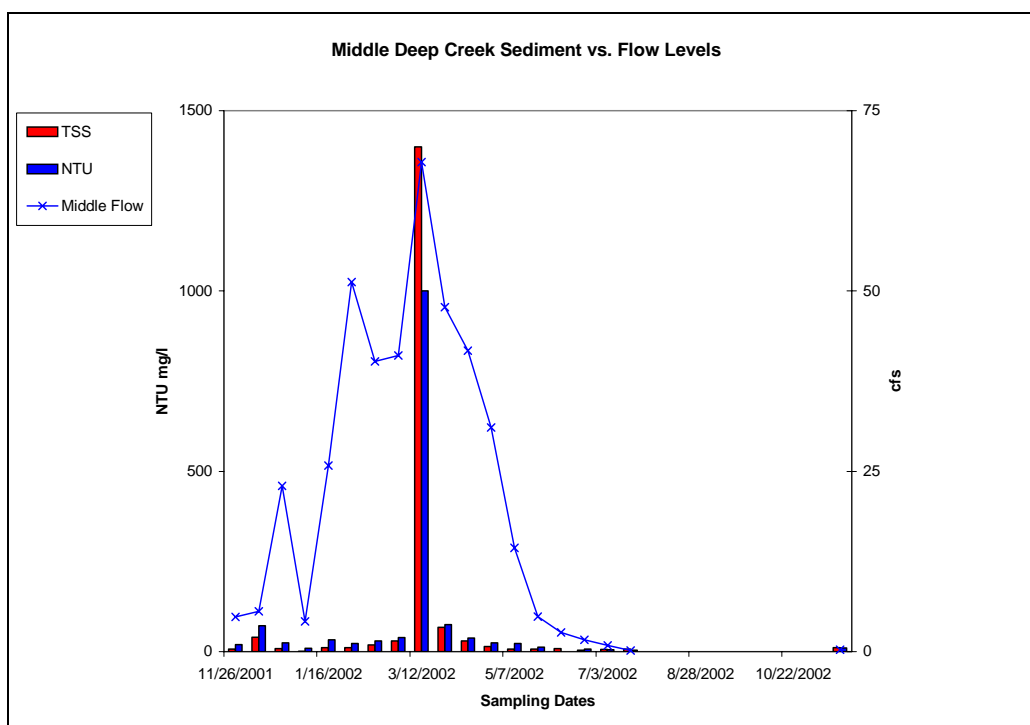


**Figure 2-12. Deep Creek DO versus Phosphorus Levels**

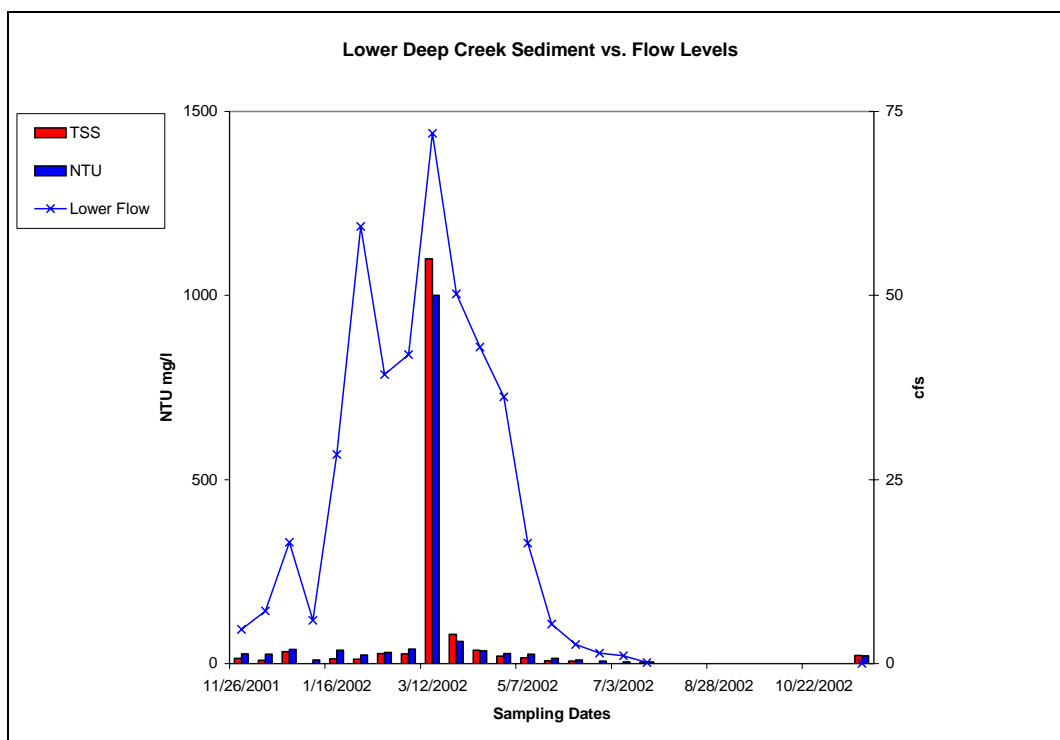
Total suspended solids (TSS), expressed in mg/L, turbidity, expressed in nephelometric turbidity units (NTU), and discharge, expressed in cubic feet per second (cfs), for all three monitoring sites, are displayed in Figures 2-13 through 2-15. TSS is a weighted measure of the total solid concentrations in the water, whether the particles are mineral (such as soil particles) or organic (such as plants). An NTU is a measure of turbidity based on a comparison of the intensity of the light scattered by the sample under defined conditions with the intensity of the light scattered by a standard reference suspension under the same conditions. These two measures are the standard indicators for sediment level concentration in surface water applications nationwide. Idaho State Standards for sediment state that sediment levels shall not impair designated beneficial uses and that turbidity shall not exceed background turbidity by more than 50 NTU instantaneously or more than 25 NTU for more than ten consecutive days.



**Figure 2-13. Deep Creek–Upper Sediment Levels**



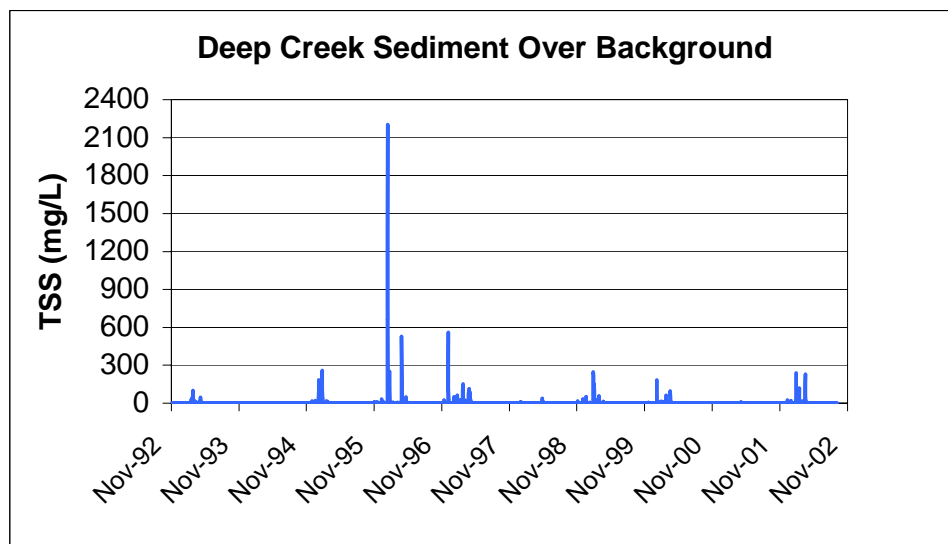
**Figure 2-14. Deep Creek-Middle Sediment Levels**



**Figure 2-15. Deep Creek -Lower- Sediment Levels**

Figures 2-13 through 2-15 display data from one point in time, repeated approximately every two weeks, for the period November 2001-November 2002. To determine if sediment levels were above state standards and impairing beneficial uses, additional calculations and assumptions were made, and a more thorough discharge profile for Deep Creek was developed. This profile is based on ten years of data collected at the USGS Palouse River gage site, watershed size differences between Deep Creek and the Palouse River, and in-stream flows collected for Deep Creek during November 2001-November 2002.

Figures 2-13 through 2-15 display numeric relationships between discharge and NTU, discharge and TSS, and NTU and TSS. These relationships can be expressed as mathematical equations, called regression equations. The regression equations used to calculate values for TSS, NTU, background TSS, background NTU and TSS levels over background are located in Appendix B. Figure 2-16 is a graph of the sediment level amounts over background for Deep Creek over a ten-year period. Based on the sediment data collected, the mathematical relationships established in this TMDL, and previous BURP data, sediment levels over background are impairing beneficial uses; therefore a sediment TMDL will be developed for Deep Creek.



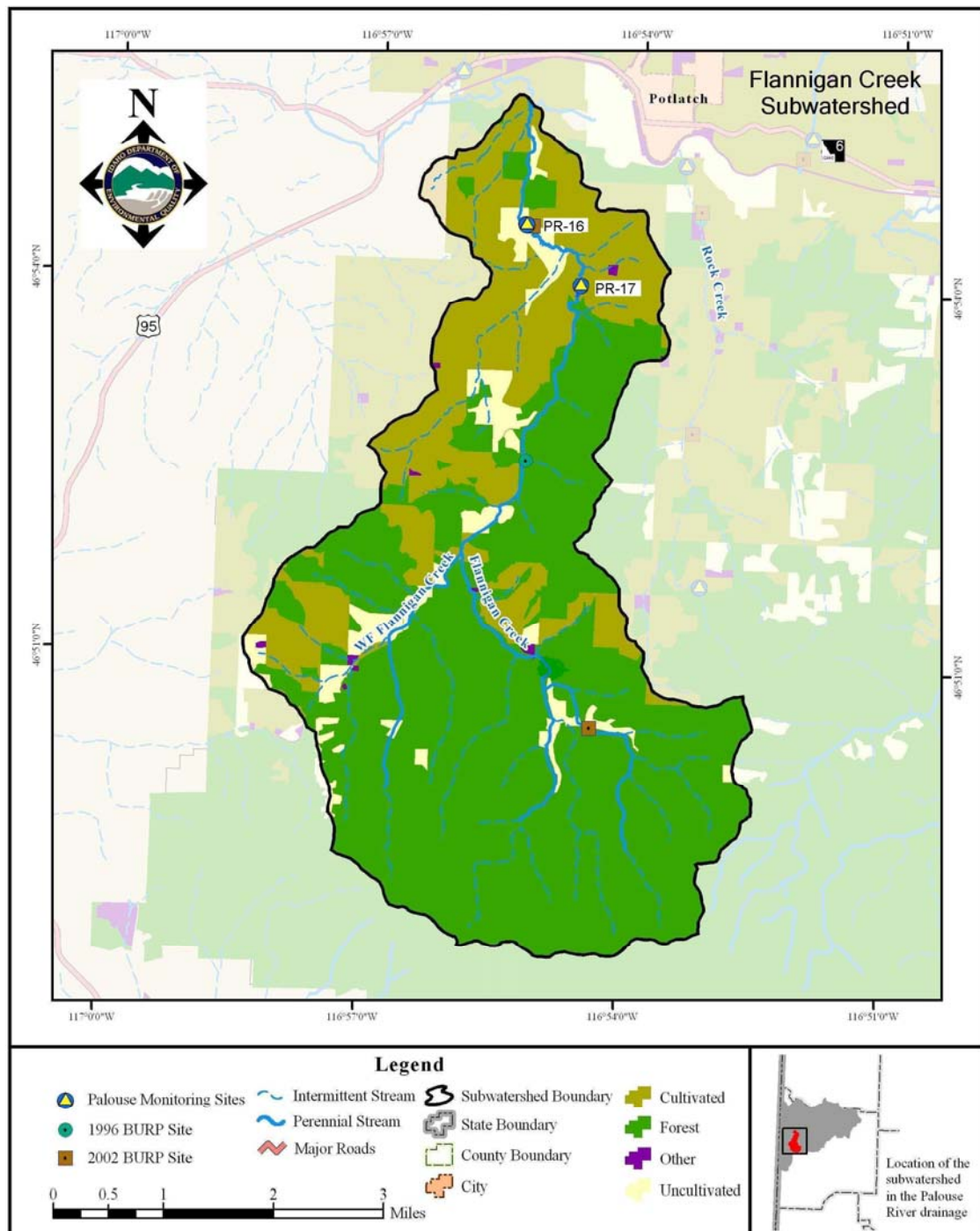
**Figure 2-16. Deep Creek over background**

### Flannigan Creek

Flannigan Creek is 303(d)-listed for sediment, temperature, nutrients, and bacteria. The boundaries are defined as headwaters to Palouse River. Flannigan Creek is a third order stream at its confluence with Palouse River, and the headwaters originate off the north side of Moscow Mountain and the Palouse Range Mountains. The entire basin is shown on Map 2-3.

The Flannigan Creek Watershed is 19.16 square miles in size (12,261 acres). Most of the land in Flannigan Creek is under private ownership. Bennett Lumber owns and manages the land in the headwaters and the state of Idaho manages some small areas as well. The primary land uses in the watershed are agriculture, grazing, forestry, urbanization and recreation.

Flannigan Creek generally flows from south to north, and the basic drainage pattern could be described as dendritic. Elevations range from 2,484 feet to 4,553 feet. The geology of the upper watershed is weathered granitics while the mid to lower portions of the watershed is dominated by the Palouse Loess. The valley bottom of the lower main stem Flannigan Creek and tributaries are underlain by coarse textured alluvium. Basalt outcroppings underlay the Palouse Loess in the lower half of the watershed, and in the valley bottoms, along the lowest portion of Flannigan Creek, coarse textured alluvium is present.



**Map 2-3. Flannigan Creek Subwatershed**

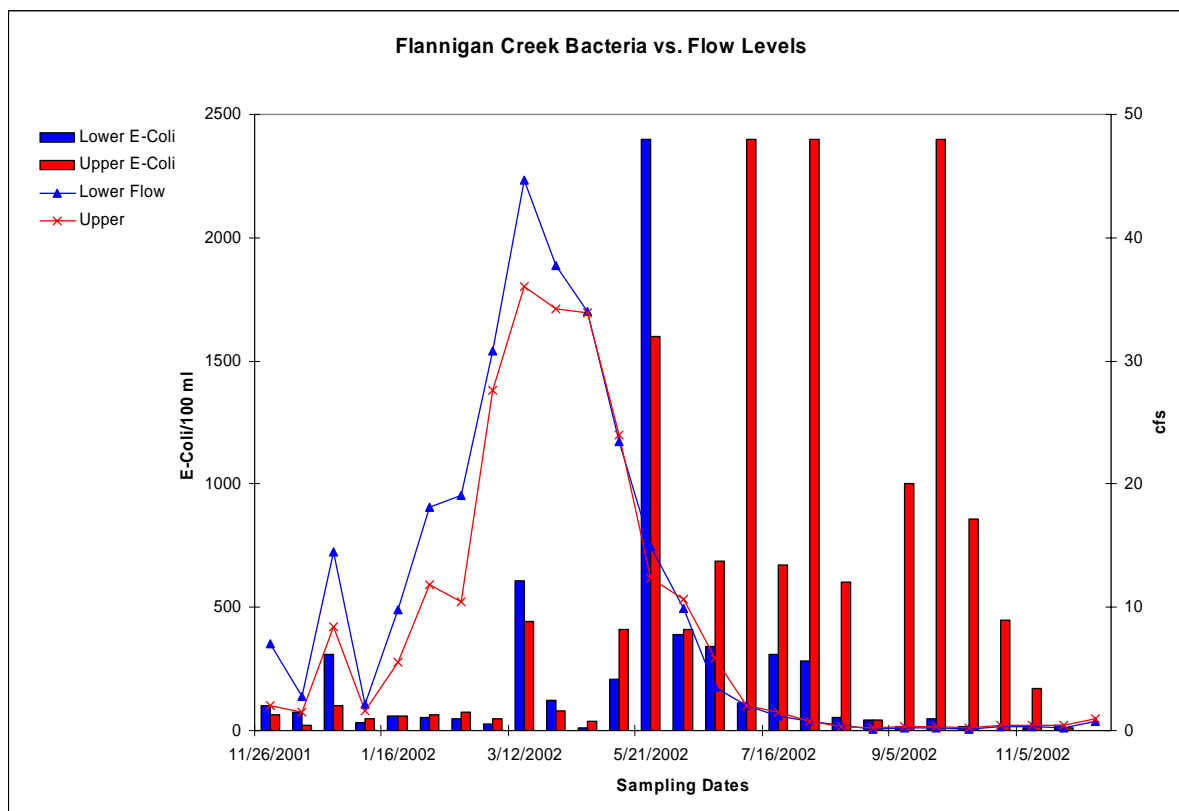
Two major tributaries, the West Fork of Flannigan Creek and the main stem Flannigan Creek, join about mid-way in the watershed. Landownership with the Flannigan Creek watershed is almost entirely private. The lower monitoring site (PR-16) is about a mile from the mouth and the upper monitoring site (PR-17) is about another mile upstream.

Agricultural, grazing, and forestry are the major land uses in the watershed. Several homes within the watershed are located near a stream and there are probably more homes within the Flannigan Creek watershed than the other 303(d) listed watersheds. Flannigan Creek itself is a perennial stream; however, some of the tributary streams in the headwaters are intermittent. Rainbow trout, dace, suckers, shiners, and northern pike minnows are some the species found in Flannigan Creek.

### Status of beneficial uses

Results from the 2001-2002 field season are displayed in Figures 2-17 through 2-24. Sediment, temperature, nutrients, and bacteria in Flannigan Creek are impairing beneficial uses. The next few paragraphs will help illustrate why sediment, temperature, nutrient, and bacteria TMDLs are required for Flannigan Creek.

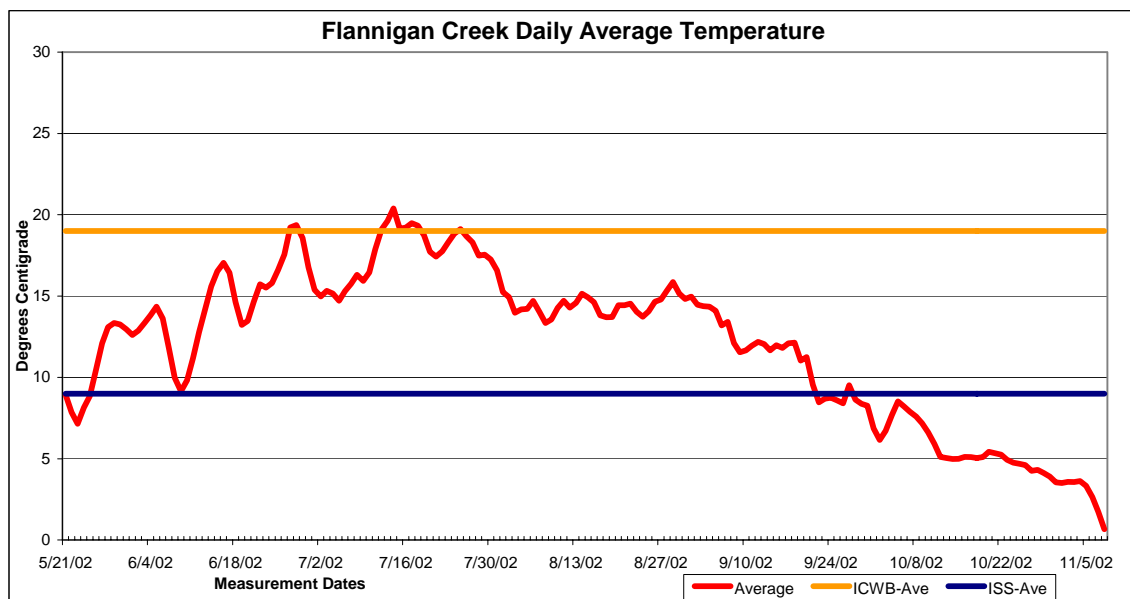
Bacteria data displayed in Figure 2-17 shows numerous exceedances of the state bacteria standard for secondary contact recreation. Both sites exceeded this value several times during the 2001-2002 monitoring season. Flannigan Creek is water quality impaired by bacteria; therefore, a bacteria TMDL will be written for Flannigan Creek.



**Figure 2-17. Flannigan Creek Bacteria Levels**

A continuous temperature data logger probe was placed near the lower monitoring site (PR-16). The probe recorded temperature readings every hour from mid-May 2002 through early

November 2002. The results are displayed in Figure 2-18. During this period, temperatures exceeded the Idaho cold water aquatic life daily average (ICWB-Ave) of 19° C and the Idaho salmonid spawning daily average (ISS-Ave) of 9° C. Based on this information a temperature TMDL will be developed for Flannigan Creek.



**Figure 2-18. Flannigan Creek Temperature**

The nutrient data are displayed in Figures 2-19 through 2-21 and Table 2-7.

A nutrient TMDL will be developed for Flannigan Creek. High total nitrogen (NO<sub>2</sub>+NO<sub>3</sub>) levels were recorded during the late fall, winter, and early spring months during the time of winter fertilizer application. Ammonia levels were at the minimum detection limit except for two relatively small increases at the lower site.

A background level of 0.035 mg/L was established based on data collected at four reference watersheds. Based on background levels, DO trends, and other regional nutrient TMDL targets, a value of 0.10 mg/L total phosphorus (TP) was established as the load capacity for this TMDL during the growing season. In addition to the TP target, DO levels must remain above 6.0 mg/L during the growing season. The nutrient target is also based on a numeric state standard for dissolved oxygen requiring the level to be greater than 6.0 mg/L at all times, and a narrative target stating that surface waters shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses. DEQ believes that by keeping TP levels below 0.10 mg/L, and by increasing stream flows, DO levels should remain above 6.0 mg/L and thereby not impair beneficial uses. Low summer flows contributed to the low DO readings in Flannigan Creek. To improve the low summer flow condition, water could be retained during the spring runoff in new or improve wetlands and riparian corridors. The water would then be stored at the surface or in shallow groundwater areas and released during the low summer flow periods and thereby improving the DO situation.

The nutrient target was violated a total of eleven times between both monitoring sites. The phosphorus target was violated a total of ten times, five at each site. Samples were collected from both upper (PR17) and lower (PR16) monitoring sites as outlined in the monitoring plan (Appendix A). Data from the lower site revealed six consecutive bi-weekly exceedances of the nutrient target, five TP reading above 0.10 mg/L and one DO level reading below 6.0 mg/L (Table 2-21). Data from the upper site revealed four consecutive bi-weekly exceedances of the nutrient target including four consecutive TP reading above 0.10 mg/L. Some aquatic plant growth was noted in Flannigan Creek. Based on the frequency and duration of the TP and DO exceedances a TMDL for nutrients will be written for Flannigan Creek.

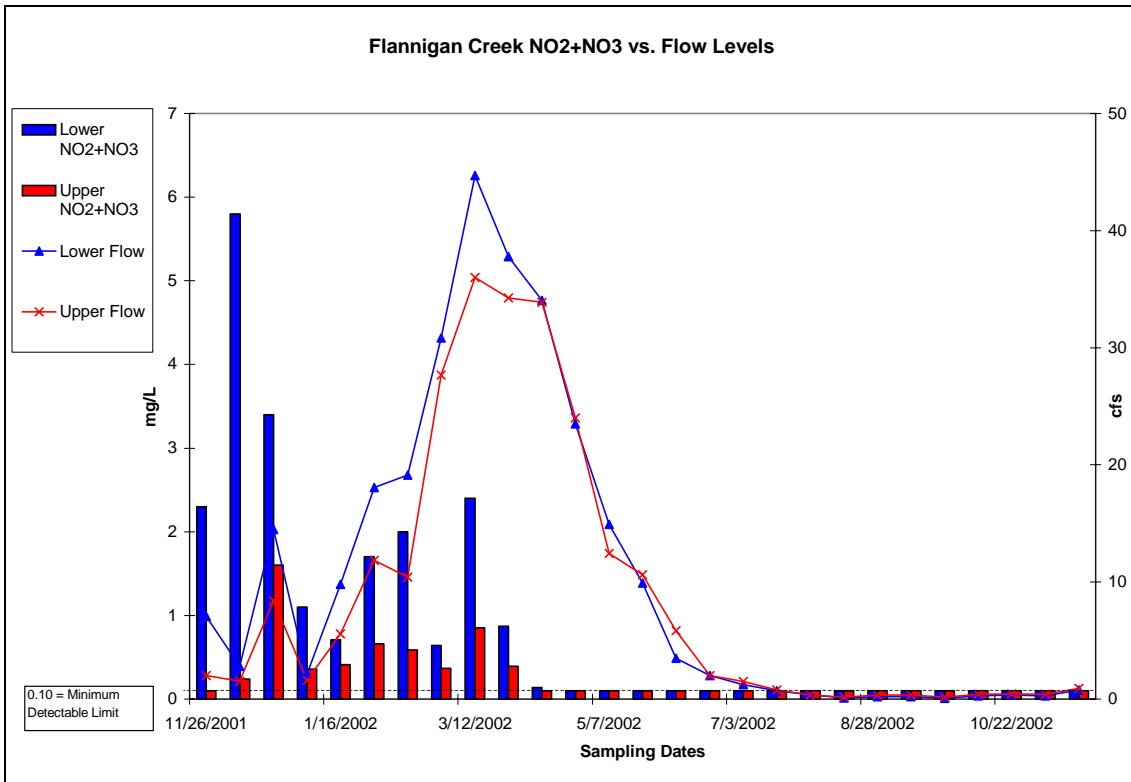
**Table 2-7. Flannigan Creek TP and DO Bi-weekly monitoring results during growing season**

Date	PR-16 (TP) <sup>1</sup>	PR-16 (DO) <sup>1</sup>	PR-16 (discharge) <sup>2</sup>	PR-17 (TP) <sup>1</sup>	PR-17 (DO) <sup>1</sup>	PR-17 (discharge) <sup>2</sup>
5/7/2002	0.07	12.43	14.91	0.07	11.99	12.42
5/21/2002	0.10	9.92	9.91	0.07	8.34	10.62
6/4/2002	0.09	8.63	3.48	0.09	10.15	5.84
<b>6/18/2002</b>	<b>0.16</b>	<b>7.81</b>	<b>2.03</b>	<b>0.14</b>	<b>8.50</b>	<b>2.02</b>
<b>7/3/2002</b>	<b>0.13</b>	<b>7.05</b>	<b>1.21</b>	<b>0.19</b>	<b>6.74</b>	<b>1.50</b>
<b>7/16/2002</b>	<b>0.12</b>	<b>7.36</b>	<b>0.72</b>	<b>0.14</b>	<b>8.28</b>	<b>0.77</b>
<b>7/29/2002</b>	<b>0.11</b>	<b>6.30</b>	<b>0.38</b>	<b>0.14</b>	<b>6.97</b>	<b>0.36</b>
<b>8/18/2002</b>	<b>0.10</b>	<b>5.70</b>	<b>0.10</b>	0.07	6.79	0.17
<b>8/28/2002</b>	<b>0.11</b>	<b>6.58</b>	<b>0.21</b>	0.08	7.00	0.34
<b>9/5/2002</b>	<b>0.10</b>	<b>6.82</b>	<b>0.22</b>	<b>0.22</b>	<b>6.82</b>	<b>0.33</b>
9/24/2002	0.07	8.23	0.08	0.05	7.90	0.18

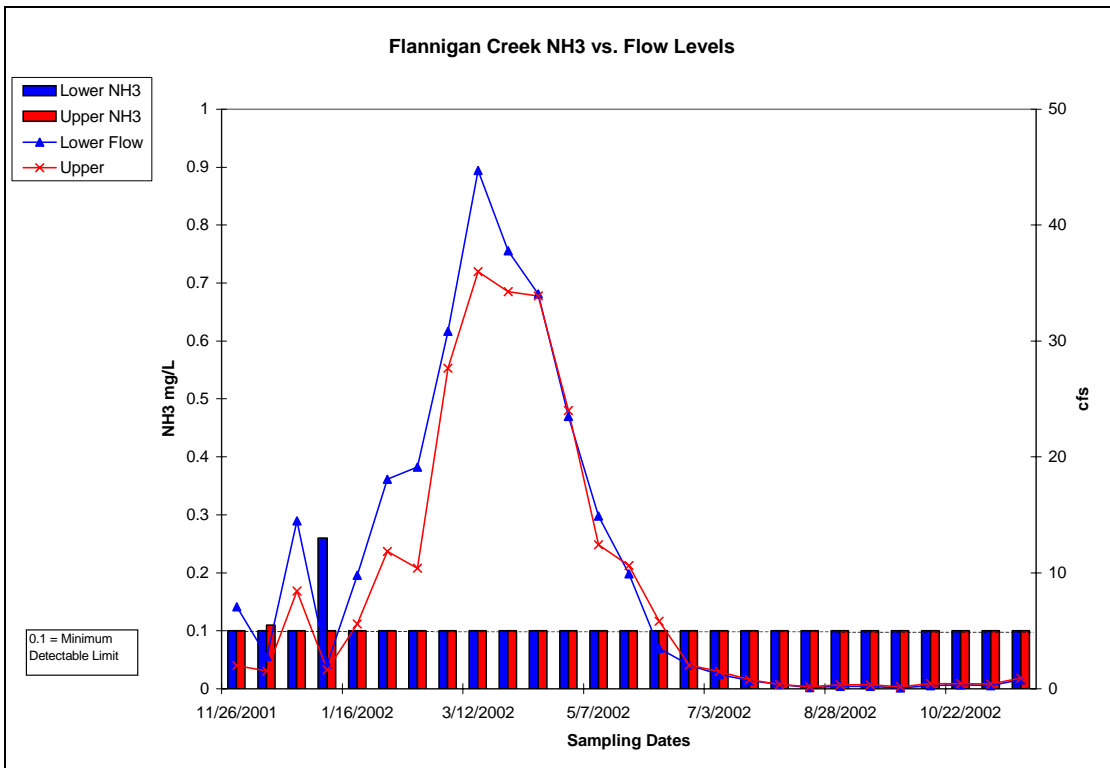
Exceedance shown in **bold**

<sup>1</sup> mg/L

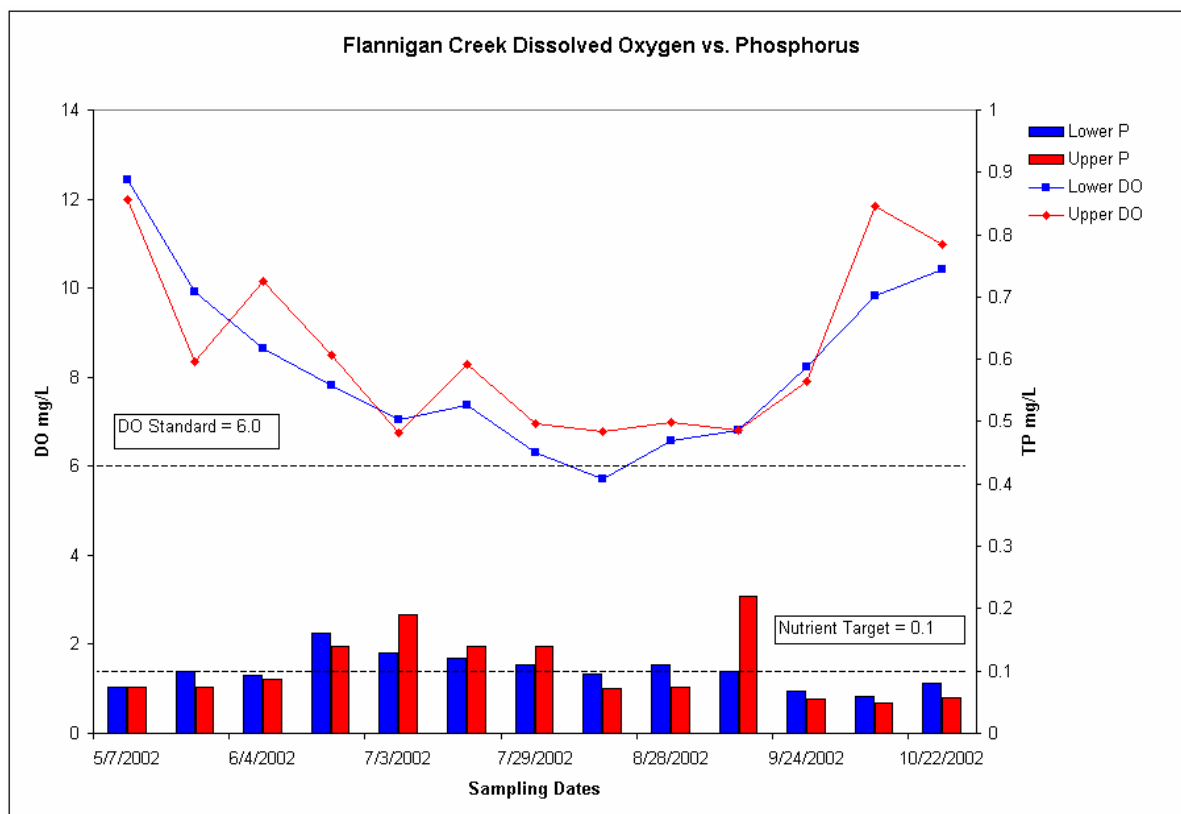
<sup>2</sup> cfs



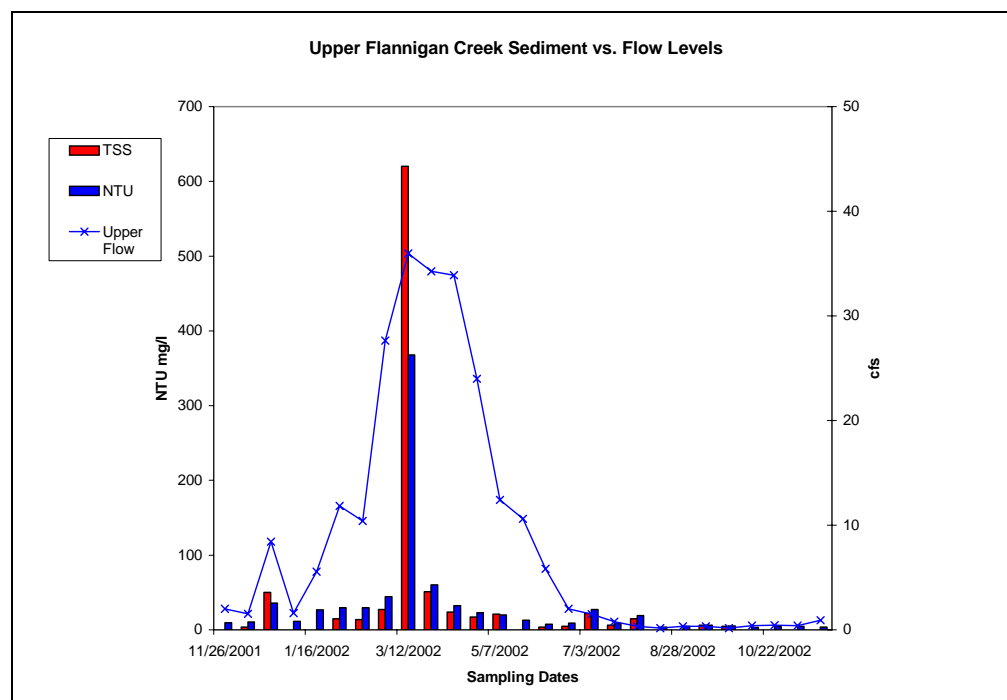
**Figure 2-19. Flannigan Creek Total Nitrogen Levels**



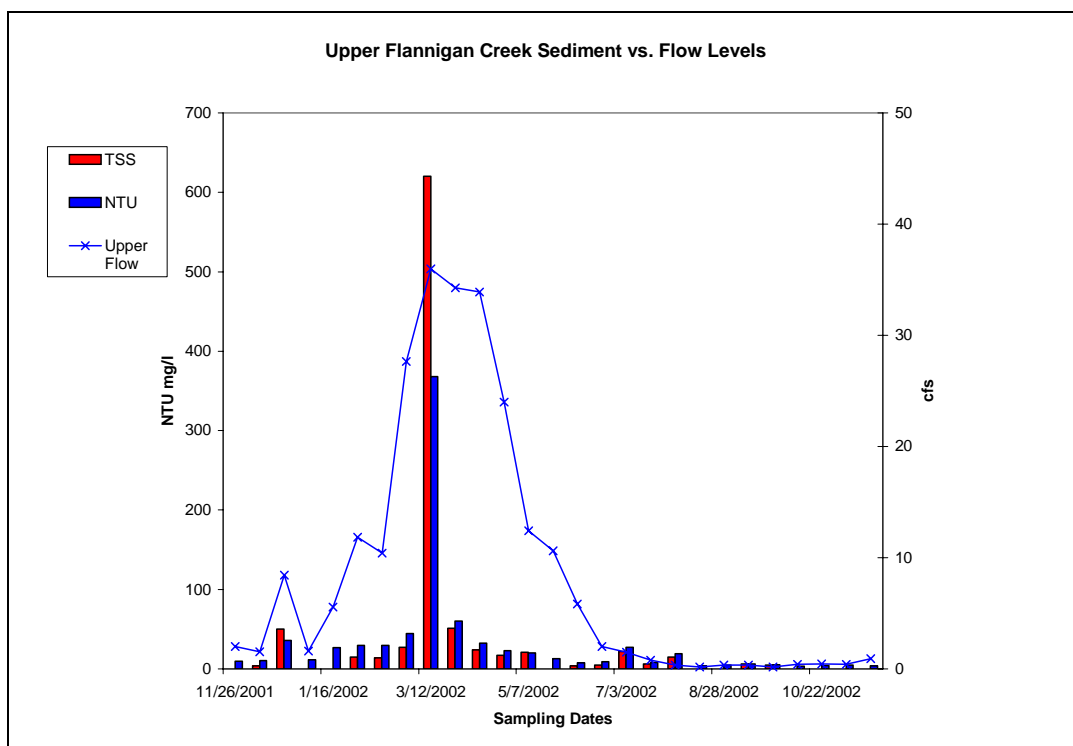
**Figure 2-20. Flannigan Creek Ammonia Levels**



**Figure 2-21. Flannigan Creek Phosphorus Levels**



**Figure 2-22. Flannigan Creek –Upper- Sediment Levels**

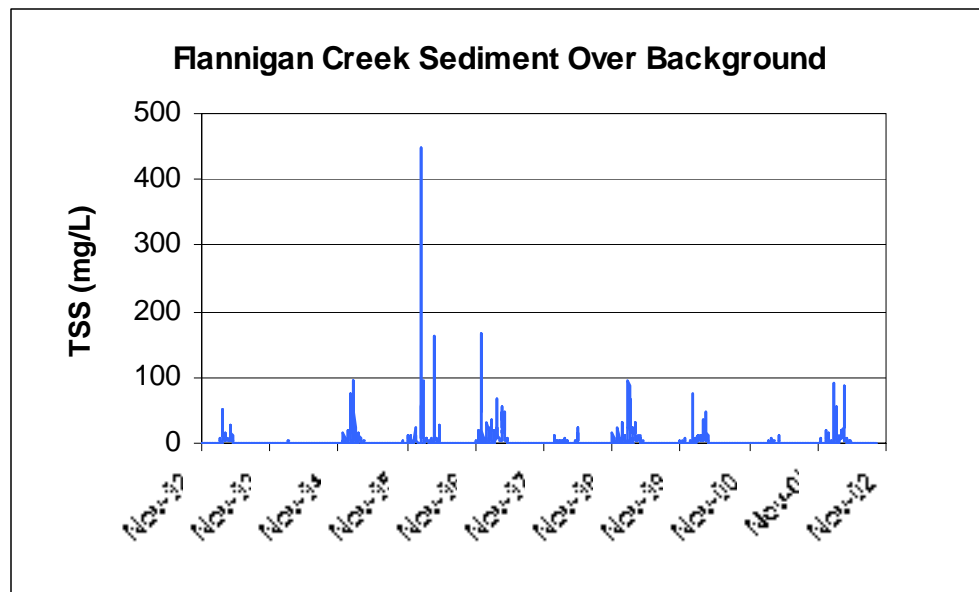


**Figure 2-23. Flannigan Creek –Lower- Sediment Levels**

Total suspended solids (TSS), expressed in mg/L, turbidity, expressed in nephelometric turbidity units (NTU), and discharge, expressed in cubic feet per second (cfs), for the upper and lower monitoring sites, are displayed in Figures 2-22 and 2-23. TSS is a weighted measure of the total solid concentrations in the water, whether the particles are mineral (such as soil particles) or organic (such as plants). An NTU is a measure of turbidity based on a comparison of the intensity of the light scattered by the sample under defined conditions with the intensity of the light scattered by a standard reference suspension under the same conditions. These two measures are the standard indicators for sediment level concentration in surface water applications nationwide. Idaho State Standards for sediment state that sediment levels shall not impair designated beneficial uses and that turbidity shall not exceed background turbidity by more than 50 NTU instantaneously or more than 25 NTU for more than ten consecutive days.

Figures 2-22 and 2-23 display data from one point in time, repeated approximately every two weeks for the period November 2001-November 2002. To determine if sediment levels were above state standards and impairing beneficial uses, additional calculations and assumptions were made. First, a more thorough discharge profile for Flannigan Creek was developed. This profile is based on ten years of data collected at the USGS Palouse River gage site, watershed size differences between Flannigan Creek and the Palouse River, and in-stream flows collected for Flannigan Creek during November 2001-November 2002.

The data shown displays numeric relationships between discharge and NTU, discharge and TSS, and NTU and TSS. These relationships can be expressed as mathematical equations, called regression equations. The regression equations used to calculate values for TSS, NTU, background TSS, background NTU and TSS levels over background are located in Appendix B. Figure 2-24 is a graph of the sediment level amounts over background for Flannigan Creek over a ten-year period. Based on the sediment data collected, the mathematical relationships established in this TMDL, and previous BURP data, sediment levels over background are impairing beneficial uses; therefore a sediment TMDL will be developed for Flannigan Creek.



**Figure 2-24. Flannigan Creek –Sediment Levels Over Background**

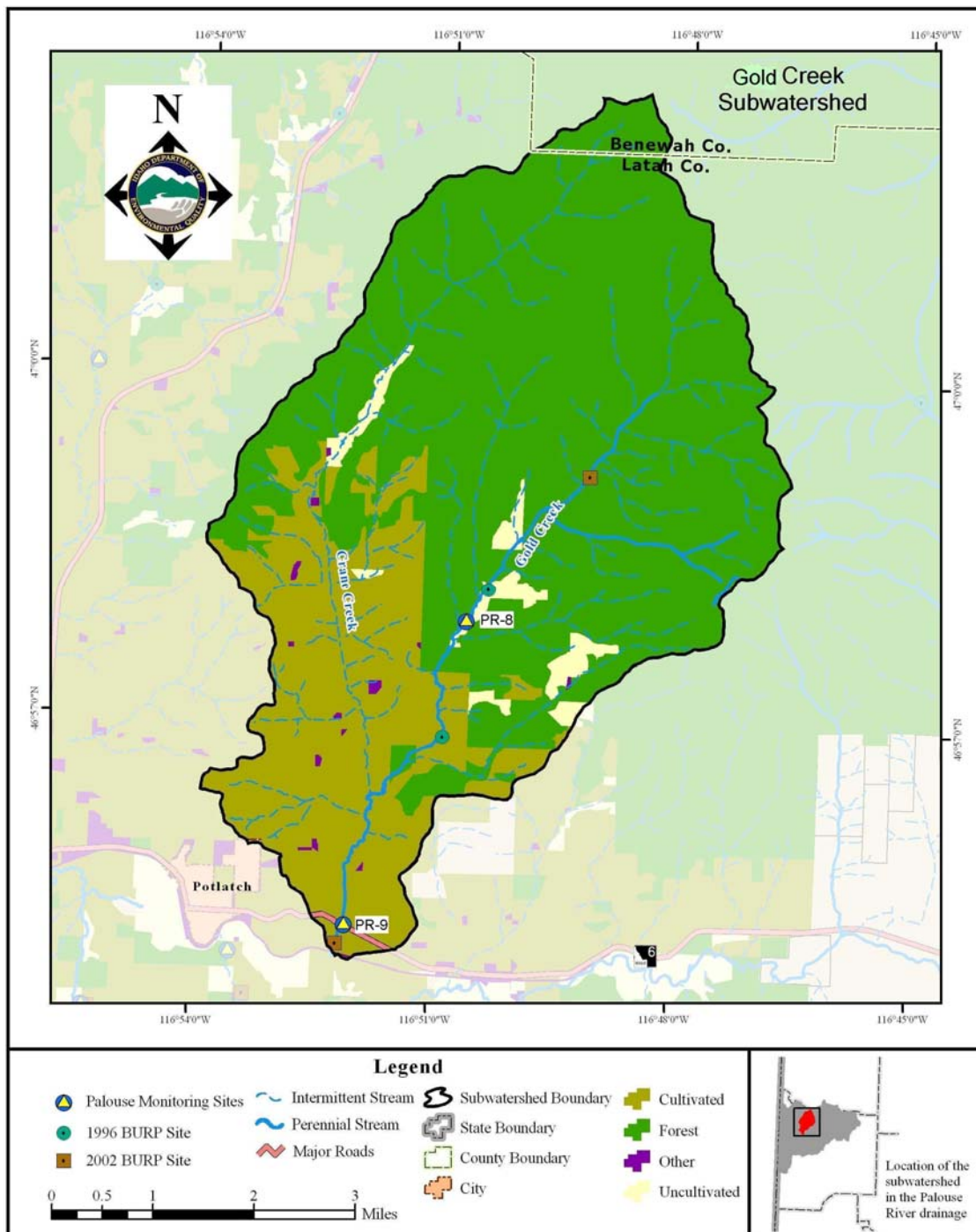
### Gold Creek

Gold Creek is 303(d)-listed for sediment, temperature, nutrients, and bacteria. The boundaries are defined as headwaters to Palouse River. Gold Creek is a fourth order stream at its confluence with the Palouse River. The headwaters originate off Crane Point and the west sides of Gold Hill and Prospect Peak. The entire basin is shown on Map 2-4.

The Gold Creek Watershed is 28.26 square miles in size (18,089 acres). Land ownership is mixed in this watershed. The upper most portion of the watershed is managed by the CNF. Bennett Corporation owns the uppermost portion of Crane Creek, a main tributary to Gold Creek. Potlatch Corporation owns the middle section of the watershed and the lower portion of the watershed is under private ownership. The major land uses in upper portion of this watershed are forestry and recreation while the major land uses the lower portion are agriculture, grazing, urbanization, forestry and recreation.

Gold Creek generally flows from north to south and the basic drainage pattern could be described as dendritic. Elevations range from 2,504 feet to 4,677 feet. Most of the upper watershed is of highly weathered metasediments although Gold Mountain, which occupies

the upper eastern portion of the watershed, is a weathered granitic outcrop. The surface geology of the lower half of the watershed is of Palouse Loess. Basalt outcroppings appear underneath the Palouse Loess in the lower portions of the watershed. The valley bottoms along the lower Gold and Crane Creek have coarse textured alluvium sediment deposition present.



Map 2-4. Gold Creek Subwatershed

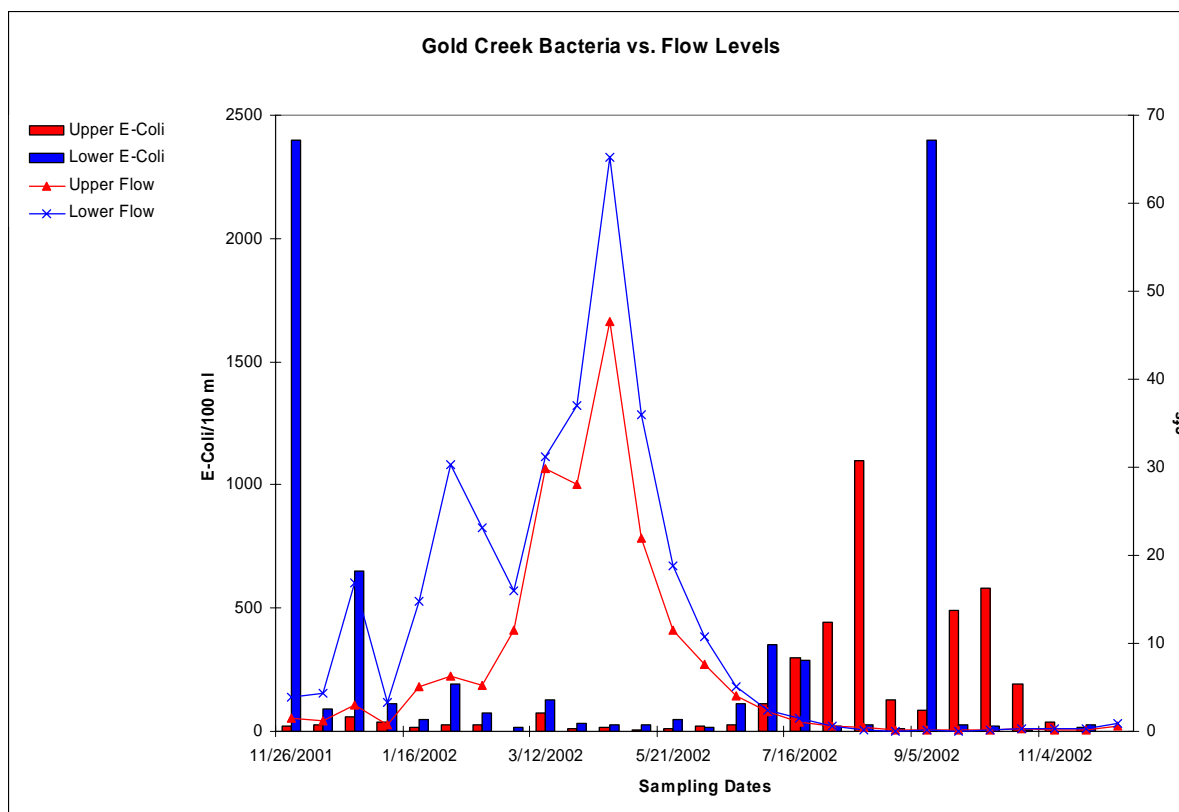
Crane Creek is the largest tributary to Gold Creek, while Hoteling Creek, Waterhole Creek, and the east fork of Gold Creek are other major tributaries to Gold Creek. The upper monitoring site (PR-8) is located just upstream of the forest-to-agriculture land-use boundary. Upstream from the upper monitoring site, forestry is the dominant land use while below the site agriculture is the dominant land use. The lower monitoring site is only a few feet from the mouth near the Gold Creek Seed/Totem Feeds business. Several homes in the lower half of the watershed are located near a stream.

Gold Creek itself is a perennial stream; however, some of the tributary streams in the headwaters are intermittent. Rainbow trout, brook trout and sculpin inhabit the upper half of the watershed while dace, suckers, shiners, and northern pike minnows inhabit the lower portion of the watershed.

### Status of beneficial uses

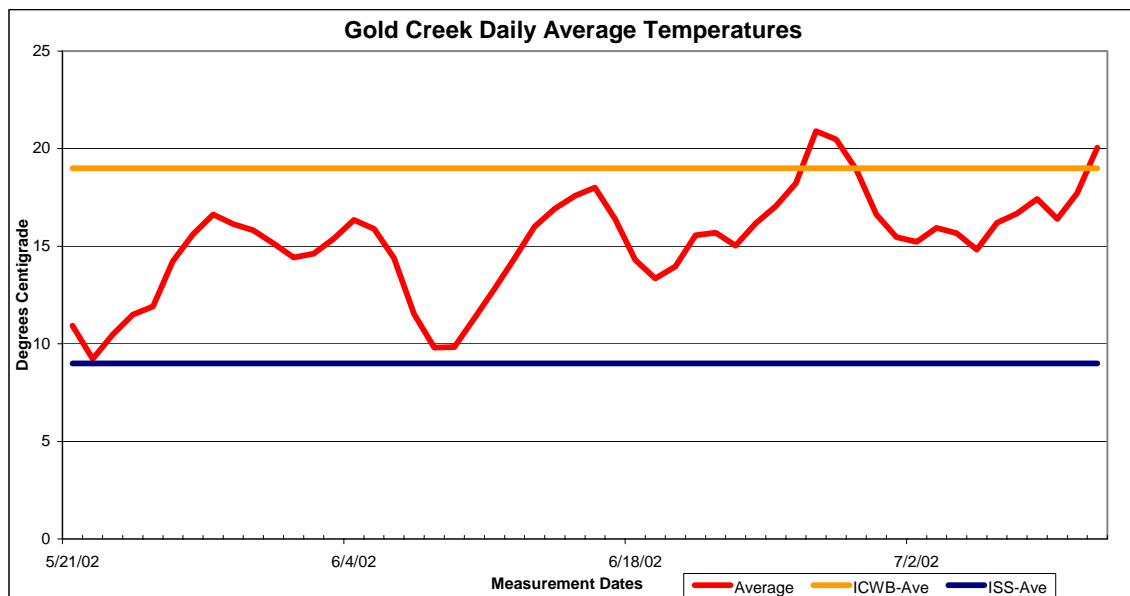
Results from the 2001-2002 field season are displayed in Figures 2-25 through 2-32. Beneficial uses are being impaired by sediment, bacteria and temperature in Gold Creek. DEQ will write a TMDLs for sediment, temperature, bacteria for Gold Creek. DEQ recommends that Gold Creek be de-listed for nutrients, as conclusions drawn from the in-stream water quality data indicate nutrient levels are not impairing beneficial uses.

Bacteria data displayed in Figure 2-25 show numerous exceedances of the state bacteria standard for secondary contact recreation. Both sites exceeded this value several times during the 2001-2002 monitoring season. Gold Creek is water quality impaired by bacteria; therefore, a bacteria TMDL will be written for Gold Creek.



**Figure 2-25. Gold Creek Bacteria Levels**

A continuous temperature data-logger probe was placed near the upper monitoring site (PR-8). The probe recorded temperature readings every hour from mid-May 2002 through early October 2002; however, the probe was knocked out of the water in mid-July and not discovered until October. The results from mid-May through mid-July are displayed in Figure 2-26. During this period, temperatures exceeded the Idaho cold water aquatic life daily average (ICWB-Ave) of 19° C, and the Idaho salmonid spawning daily average (ISS-Ave) of 9° C. Based on this information, a temperature TMDL will be developed for Gold Creek.



**Figure 2-26. Gold Creek Temperature**

The nutrient data are displayed in Figures 2-27 through 2-29. A target of 0.10 mg/L total phosphorus (TP) and/or a dissolved oxygen level below 6.0 mg/L during the growing season was established for this TMDL. Ammonia levels were at the minimum detection limit except for a few minor increases. Nitrogen levels were below surface water guidelines, although some nitrogen levels were detected in the lower site.

The nutrient target is based on a numeric state standard for dissolved oxygen requiring the level to be greater than 6.0 mg/L at all times, and a narrative target stating that surface waters shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses. The lower site had one violation of the DO standard.

The upper site had one exceedance of the TP target; however, the exceedance seems somewhat of an anomaly for the upper site. The violation was in September and was an order of magnitude larger than the other results. This could have been an error at the lab after collection, an error sometime during the preparation (perhaps in the sample container), during collection in the field, or during the transportation and transfer of the sample. DEQ believes this reading to be an error, and although it is displayed in Figure 2-29 and in Table 2-1, we are not including that point for TMDL analysis.

Within the Water Body Assessment Guidance (Grafe et al., 2002), section 5.2.1, DEQ guidance allows for some exceedances provided if the exceedances are less than 10 percent of the total data set and there is no other measurable impairment. Gold Creek (lower) violated the DO standard on one occasion, when flow was less than one-tenth (0.1) cubic feet per second (cfs)—a very small trickle.

The nutrient standard is narrative and states that waters should be free of nuisance aquatic growth. Based on sites visits and field crew report, DEQ believes there is not a nuisance aquatic growth problem in Gold Creek. DEQ believes that a lack of flow (minimum flow) is the cause of the low DO reading on 8/18/2002 (Table 2-8). Based on DEQ guidance and field conditions, DEQ recommends that Gold Creek be removed for nutrients as a pollutant.

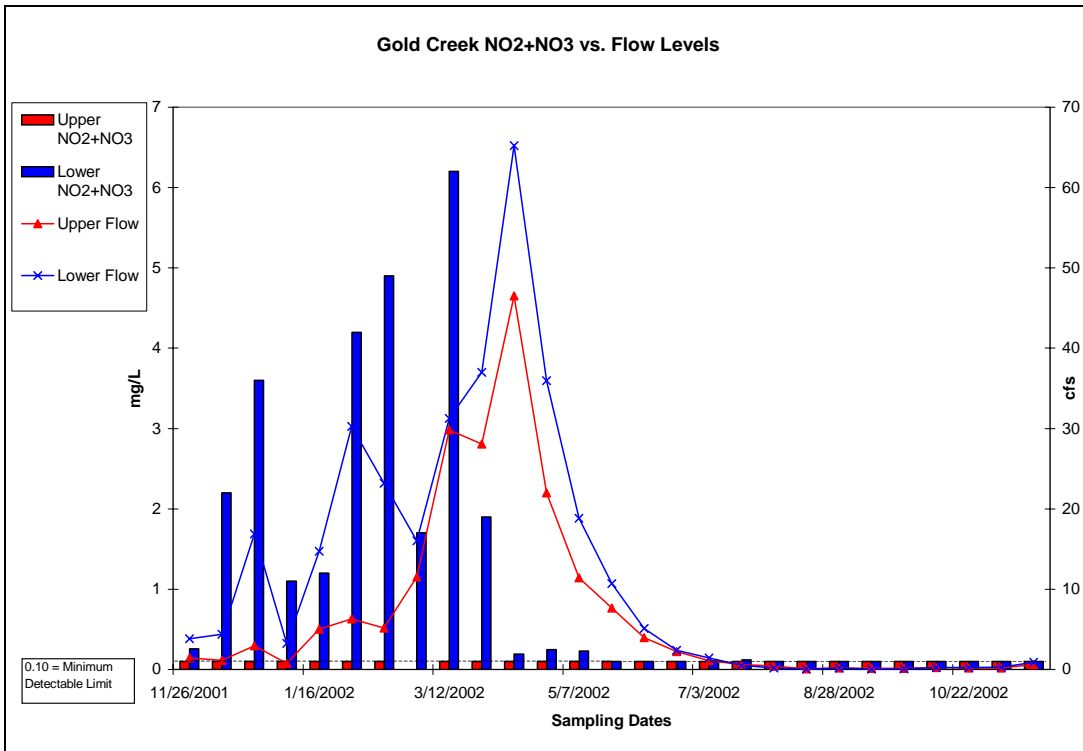
**Table 2-8 Gold Creek TP and DO bi-weekly monitoring results during growing season**

Date	PR-9 (TP) <sup>1</sup>	PR-9 (DO) <sup>1</sup>	PR-9 (discharge) <sup>2</sup>	PR-8 (TP) <sup>2</sup>	PR-8 (DO) <sup>1</sup>	PR-8 (discharge) <sup>2</sup>
5/7/2002	0.05	13.15	18.86	0.05	11.58	11.44
5/21/2002	0.06	10.83	10.72	0.04	10.30	7.64
6/4/2002	0.06	11.06	5.14	0.06	10.13	3.96
6/18/2002	0.09	9.88	2.40	0.09	9.04	2.26
7/3/2002	0.06	8.52	1.42	0.06	8.49	1.11
7/16/2002	0.08	9.21	0.53	0.08	7.86	0.62
7/29/2002	0.08	7.03	0.19	0.06	9.00	0.43
<b>8/18/2002</b>	<b>0.08</b>	<b>5.55</b>	0.03	0.06	7.16	0.10
8/28/2002	0.08	6.62	0.21	0.06	8.65	0.17
9/5/2002	0.06	6.88	0.07	0.19	8.02	0.14
9/24/2002	0.07	8.97	0.09	0.09	9.55	0.14

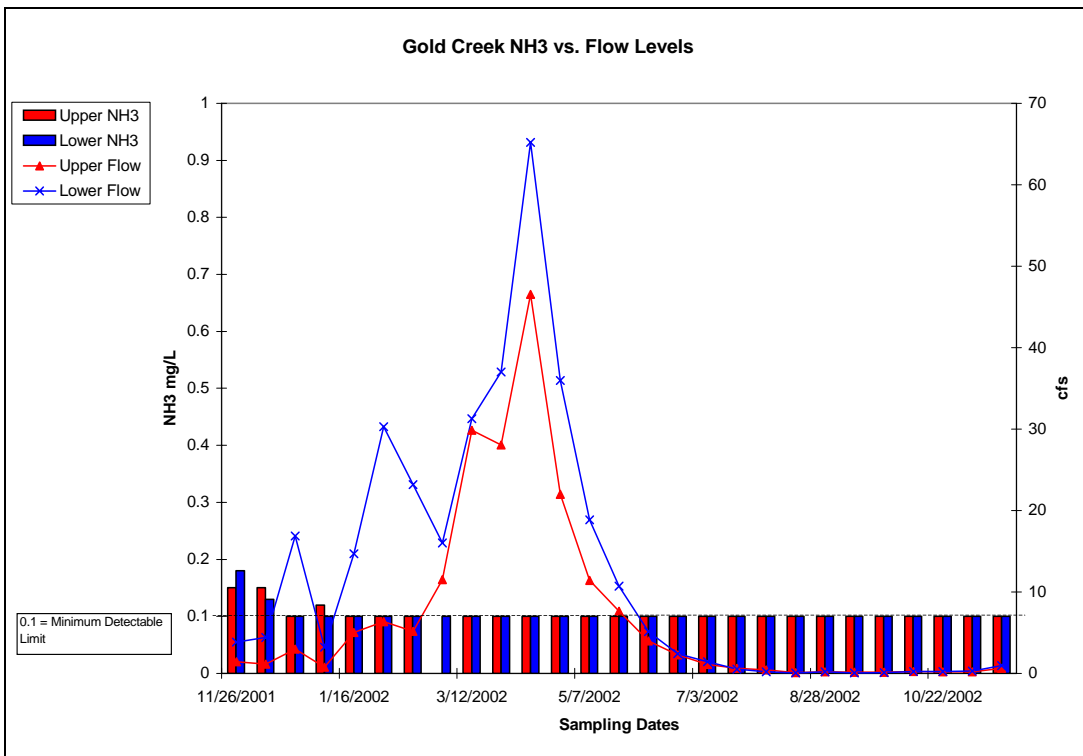
Exceedance shown in **bold**

<sup>1</sup> mg/L

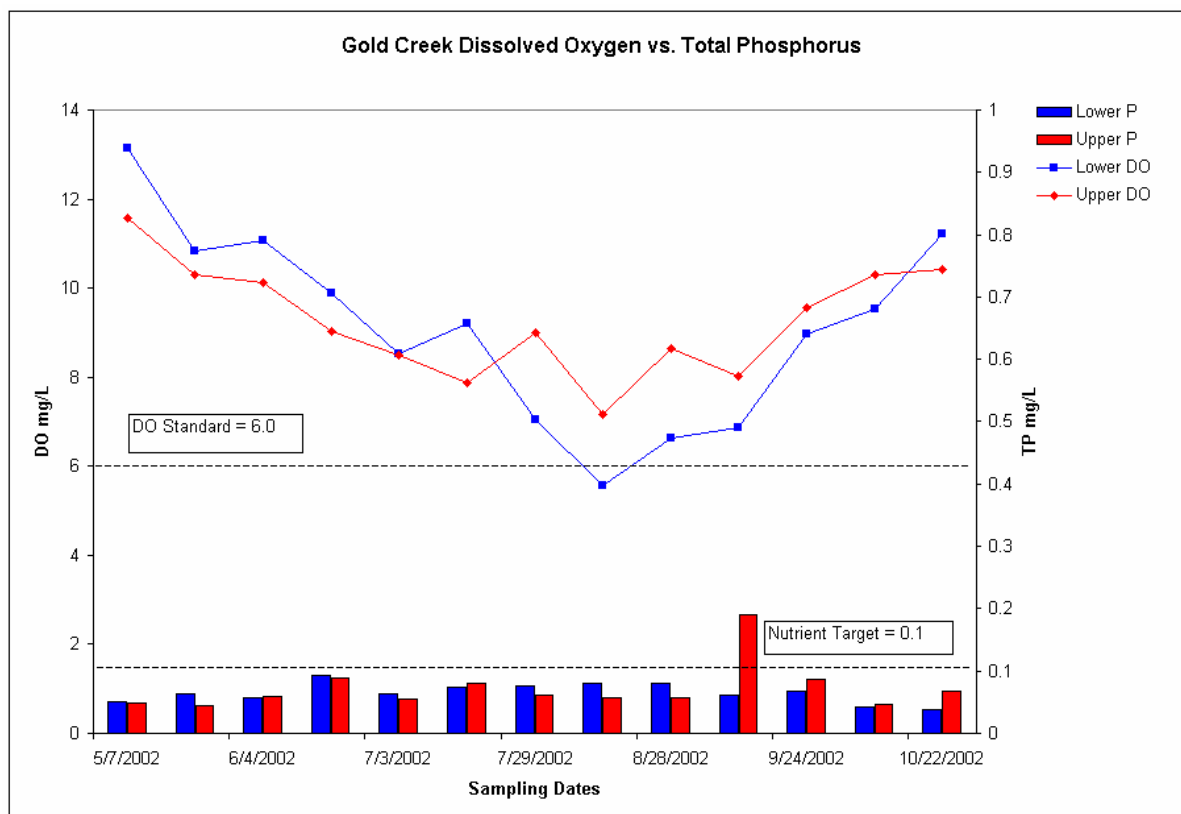
<sup>2</sup> cfs



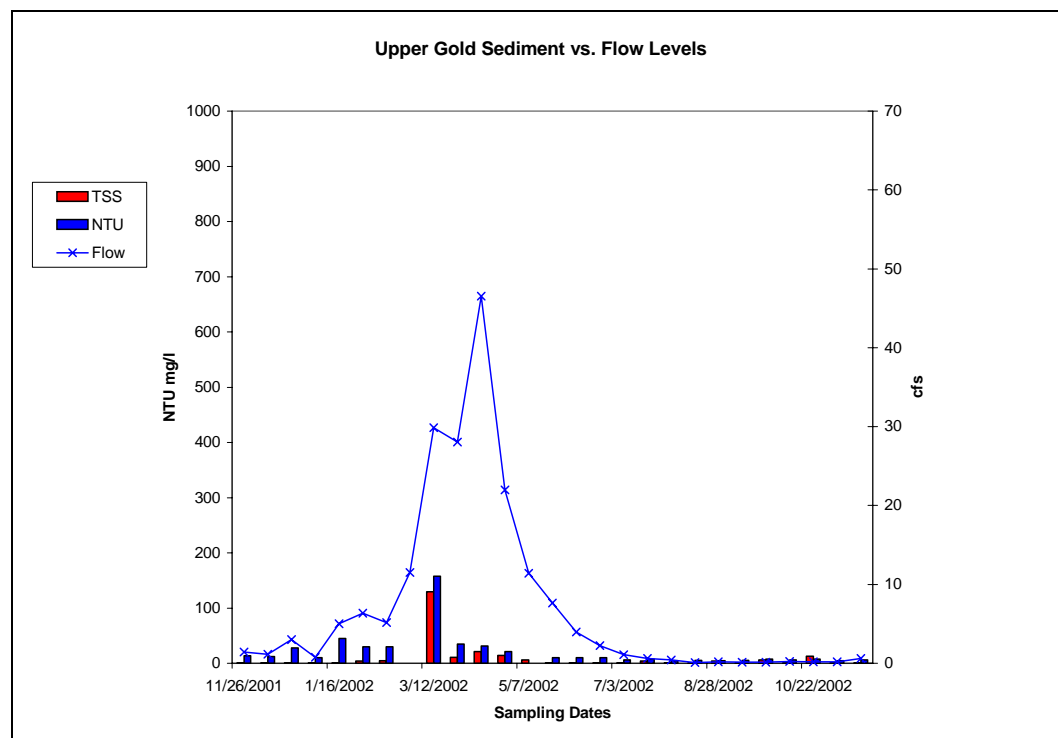
**Figure 2-27. Gold Creek Total Nitrogen Levels**



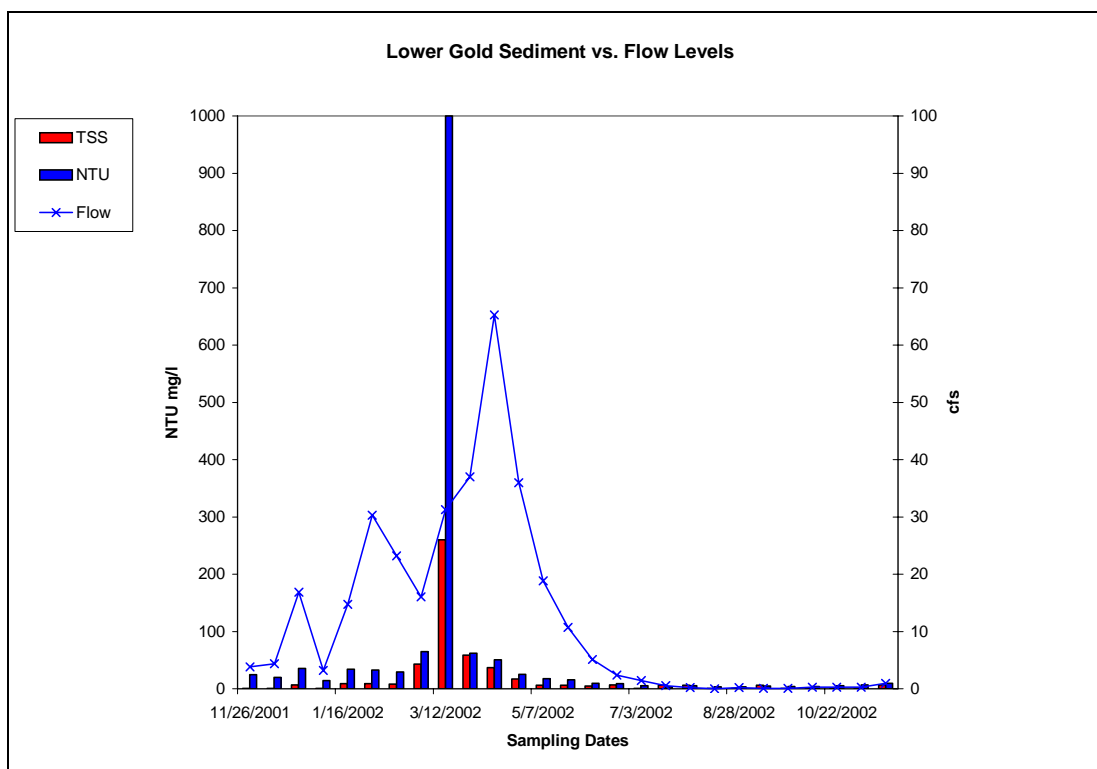
**Figure 2-28. Gold Creek Ammonia Levels**



**Figure 2-29. Gold Creek DO versus Phosphorus Levels**



**Figure 2-30. Gold Creek –Upper- Sediment Levels**

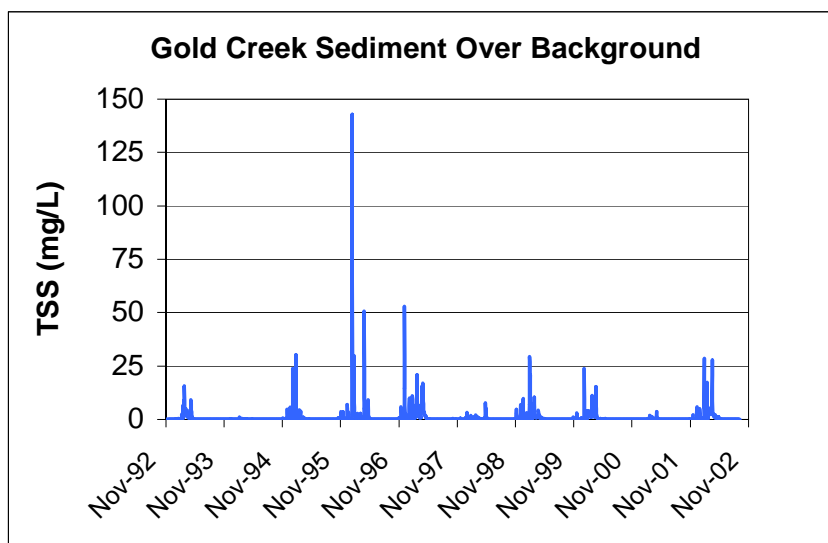


**Figure 2-31. Gold Creek –Lower- Sediment Levels**

Total suspended solids (TSS), expressed in mg/L, turbidity, expressed in nephelometric turbidity units (NTU), and discharge, expressed in cubic feet per second (cfs), for the upper and lower monitoring sites, are displayed in Figures 2-30 through 2-31. TSS is a weighted measure of the total solid concentrations in the water, whether the particles are mineral (such as soil particles) or organic (such as plants). An NTU is a measure of turbidity based on a comparison of the intensity of the light scattered by the sample under defined conditions with the intensity of the light scattered by a standard reference suspension under the same conditions. These two measures are the standard indicators for sediment level concentration in surface water applications nationwide. Idaho State Standards for sediment state that sediment levels shall not impair designated beneficial uses and that turbidity shall not exceed background turbidity by more than 50 NTU instantaneously or more than 25 NTU for more than ten consecutive days.

Figures 2-30 and 2-31 display data from one point in time, repeated approximately every two weeks for the period November 2001-November 2002. To determine if sediment levels were above state standards and impairing beneficial uses, additional calculations and assumptions were made. First, a more thorough discharge profile for Gold Creek was developed. This profile is based on ten years of data collected at the USGS Palouse River gage site, watershed size differences between Gold Creek and the Palouse River, and in-stream flows collected for Gold Creek during November 2001-November 2002.

The data shown display numeric relationships between discharge and NTU, discharge and TSS, and NTU and TSS. These relationships can be expressed as mathematical equations, called regression equations. The regression equations used to calculate values for TSS, NTU, background TSS, background NTU and TSS levels over background are located in Appendix B. Figure 2-32 is a graph of the sediment level amounts over background for Gold Creek over a ten-year period. Based on the sediment data collected, the mathematical relationships established in this TMDL, and previous BURP data, sediment levels over background are impairing beneficial uses; therefore a sediment TMDL will be developed for Gold Creek.



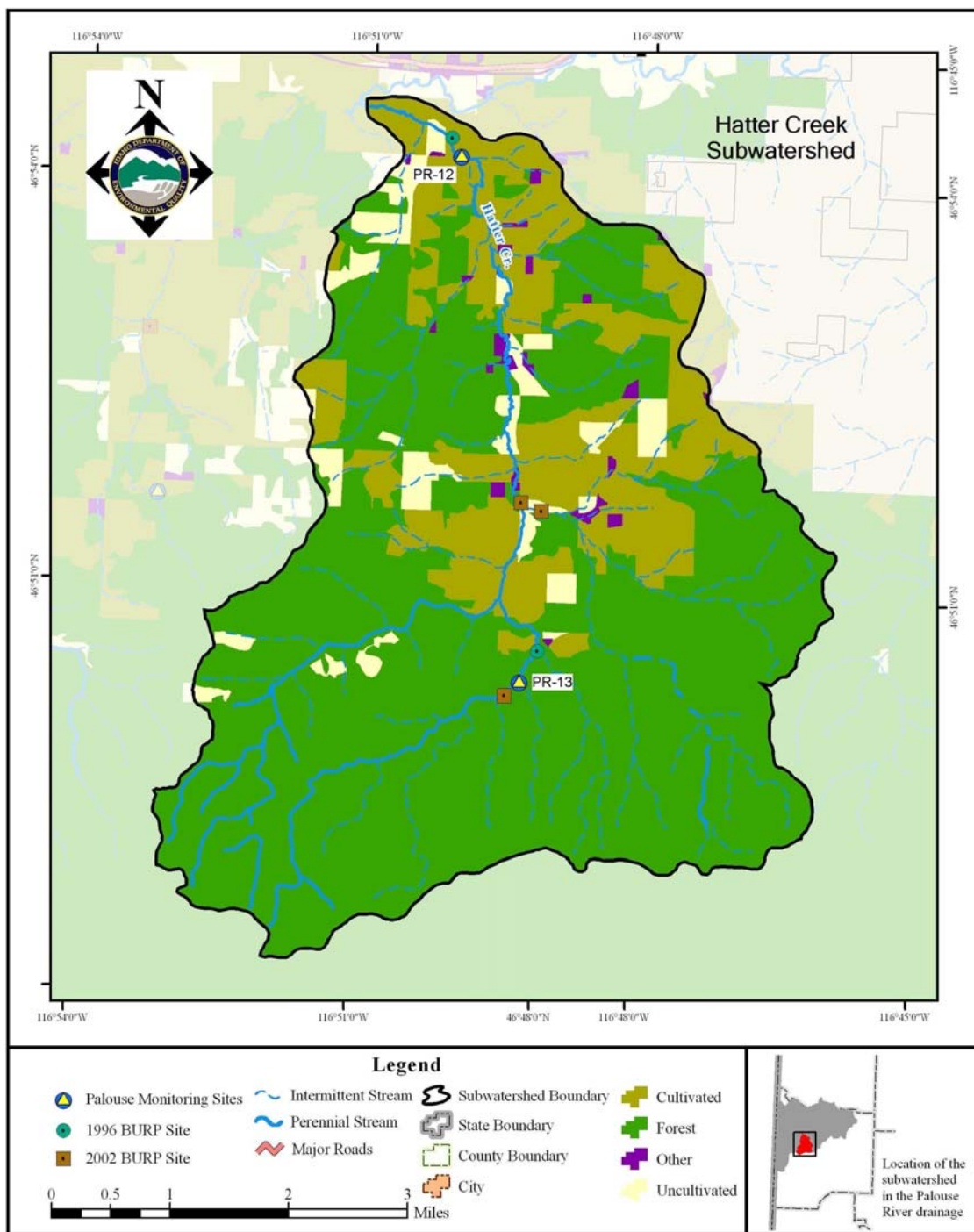
**Figure 2-32. Gold Creek –Sediment Levels over Background**

### Hatter Creek

Hatter Creek is 303(d)-listed for sediment, temperature, nutrients, and bacteria. The boundaries are defined as headwaters to Palouse River. Hatter Creek is a fourth order stream at its confluence with Palouse River. The headwaters originate off the north side of Moscow Mountain. The entire basin is shown on Map 2-5.

The Hatter Creek Watershed is 25.28 square miles in size (16,181 acres). Most of the land in Hatter Creek is under private ownership. A significant portion of the uppermost watershed is the University of Idaho Experimental Forest managed by the University of Idaho. Bennett Lumber owns the uppermost portion of the watershed. The primary land uses in the upper watershed are forestry, agriculture, grazing and recreational activities, while the lower watershed land uses are agriculture, grazing and recreational activities.

Hatter Creek generally flows from south to north and the basic drainage pattern could be described as dendritic. Elevations range from 2,511 feet to 4,983 feet. The geology of the upper watershed is weathered granitics while the mid to lower portions of the watershed are dominated by the Palouse Loess. In the lower portion of the watershed metaphoric rocks underlay the Palouse Loess formations. In the valley bottoms along lower Hatter Creek, coarse textured alluvium sediment deposition is present.



**Map 2-5. Hatter Creek Subwatershed**

Long Creek and the main stem Hatter Creek join in the upper-mid section of the watershed, which is also close to the forest-agricultural land use boundary. Just upstream from there, on the main stem Hatter creek, is the upper monitoring site (PR-13). Upstream from the upper

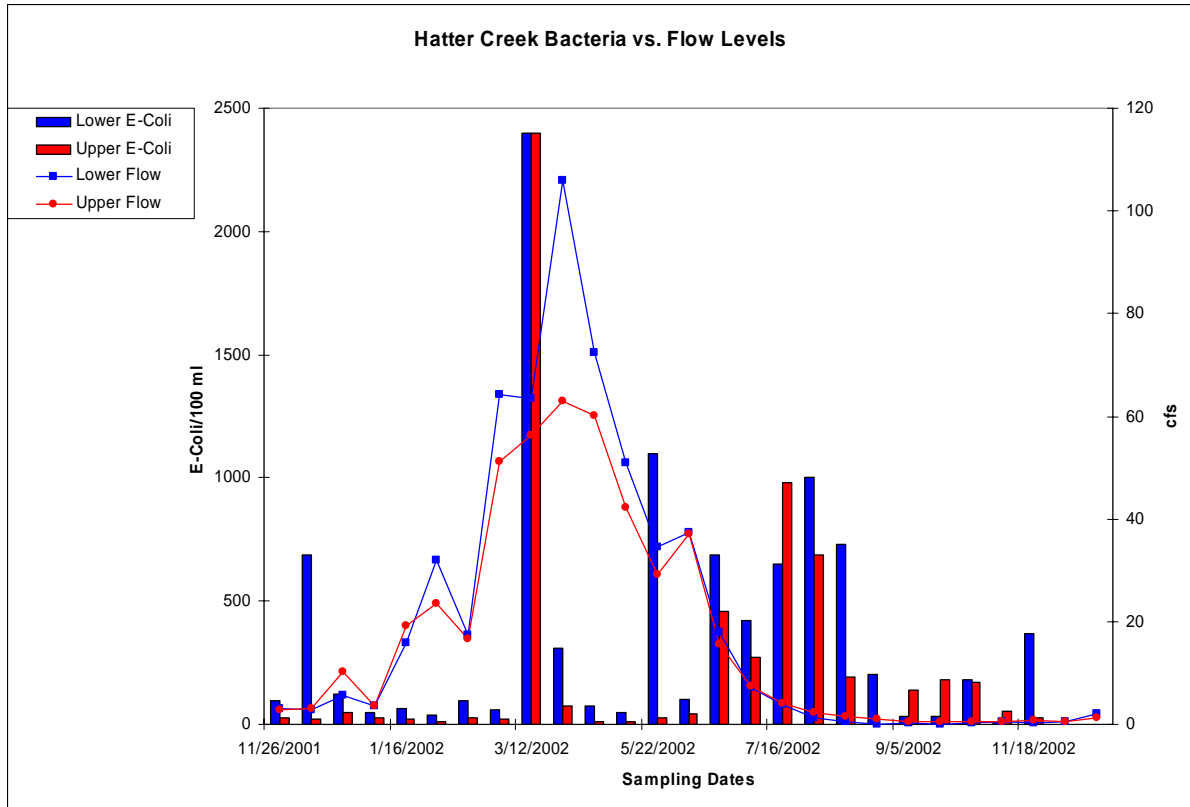
monitoring site, forestry is the dominant land use, while below the site agriculture is the dominant land use. The lower monitoring site (PR-12) is about a mile from the mouth. The main stem Hatter Creek has several grazing pastures between the upper and lower sites. The main road into this watershed parallels the main stem Hatter Creek for many miles. This road in particular has several cut slope and fill slope failures directly into Hatter Creek. There are several homes along Hatter Creek from the middle to lower portion of the watershed.

Hatter Creek itself is a perennial stream; however, some of the tributary streams in the watershed are intermittent. Rainbow trout, brook trout, dace, and shiners are some the species found in Hatter Creek. Based on stream fish data Hatter Creek has the potential to be a productive recreational fishery; however, based on field observations this watershed has several problem areas that are polluting Hatter Creek. During implementation, DEQ recommends that this watershed be looked at closely and promptly for possible BMPs to improve water quality.

### Status of beneficial uses

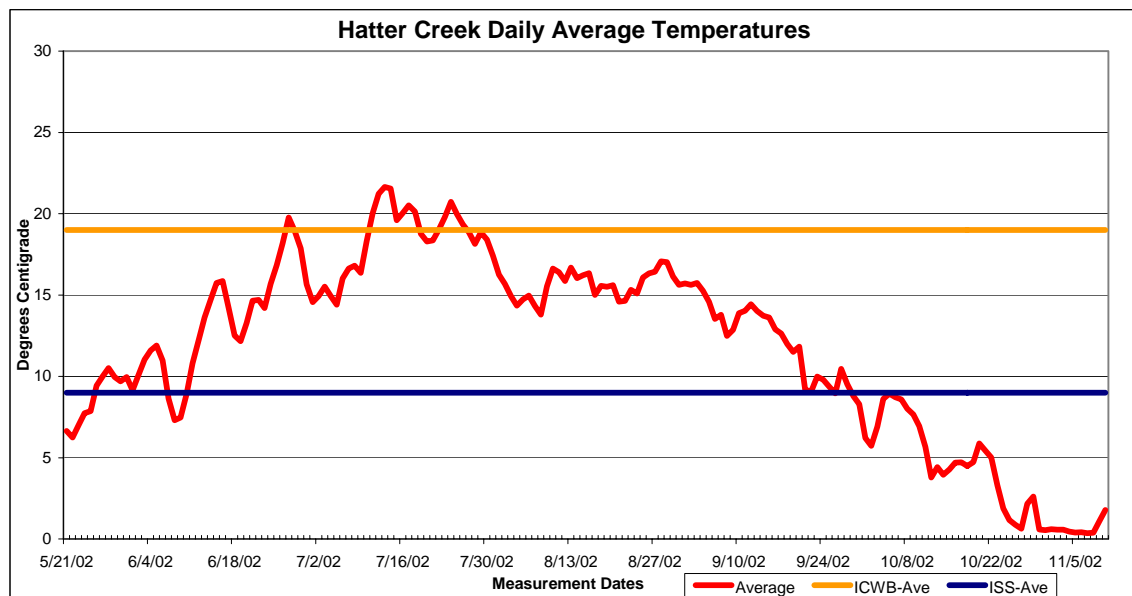
Results from the 2001-2002 field season are displayed in Figures 2-33 through 2-40. Beneficial uses are being impaired by sediment, bacteria, and temperature in Hatter Creek. In addition, the lower half of Hatter Creek is also impaired by nutrients. DEQ will write TMDLs for sediment, temperature, and bacteria for Hatter Creek, and a nutrient TMDL will be written for the lower half of Hatter Creek. DEQ recommends that the upper half of Hatter Creek be de-listed for nutrients, as conclusions drawn from the in-stream water quality data indicate nutrient levels are not impairing beneficial uses.

Bacteria data displayed in Figure 2-33 shows numerous exceedances of the state bacteria standard for secondary contact recreation. Both sites exceeded this value several times during the 2001-2002 monitoring season. On a yearly average, Hatter Creek has the highest bacteria readings of any of the 303(d) streams. Hatter Creek is water quality impaired by bacteria; therefore, a bacteria TMDL will be written.



**Figure 2-33. Hatter Creek Bacteria Levels**

A continuous temperature data-logger probe was placed near the lower monitoring site (PR-12). The probe recorded temperature readings every hour from mid-May 2002 through the first part of November 2002. The results are displayed in Figure 2-34. During this period, temperatures exceed the Idaho cold water aquatic life daily average (ICWB-Ave) of 19° C, and the Idaho salmonid spawning daily average (ISS-Ave) of 9° C. Based on this information, a temperature TMDL will be developed for Hatter Creek.



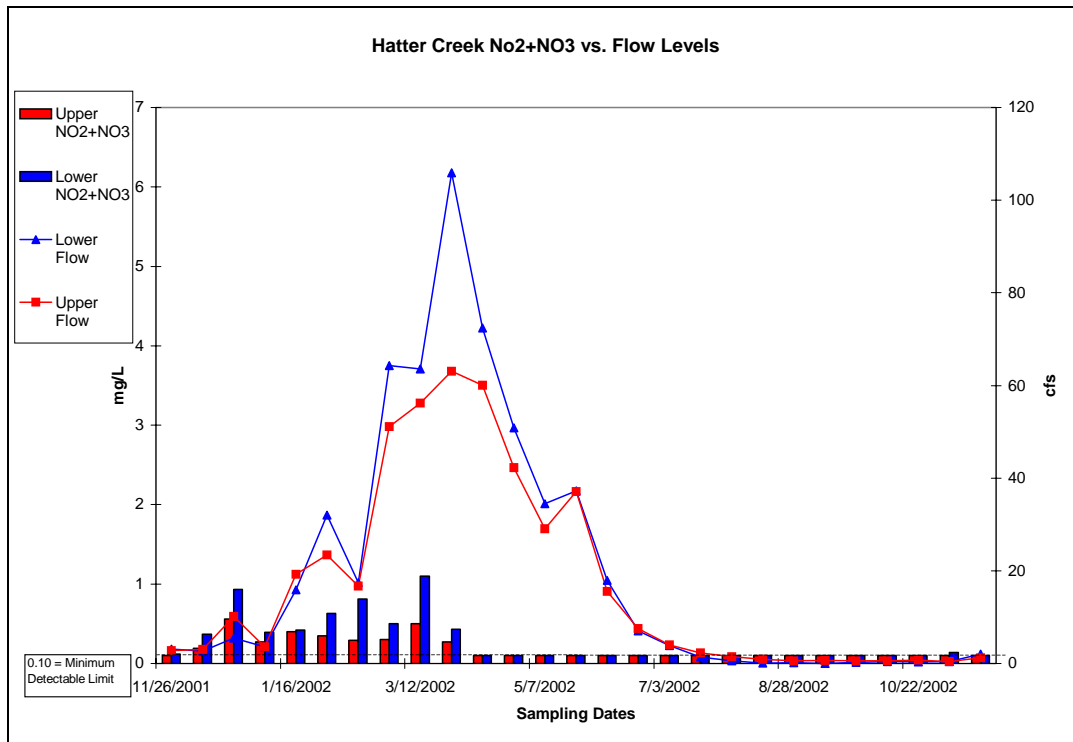
**Figure 2-34. Hatter Creek Temperature**

The nutrient data are displayed in Figures 2-35 through 2-37 and Table 2-9. NO<sub>2</sub>+NO<sub>3</sub> levels were very slightly elevated during the winter and early spring months. Ammonia levels were at the minimum detection limit except for a few increases, which were all below the state standard. A target of 0.10 mg/L TP and/or a dissolved oxygen level below 6.0 mg/L during the growing season was established for this TMDL. Field crews observed some algae growth in the lower sections of Hatter Creek.

“A background level of 0.035 mg/L was established based on data collected at four reference watersheds. Based on background levels, DO trends, and other regional nutrient TMDL targets, a value of 0.10 mg/L TP was established as the load capacity for this TMDL during the growing season. In addition to the TP target, DO levels must remain above 6.0 mg/L during the growing season. The nutrient target is also based on a numeric state standard for dissolved oxygen requiring the level to be greater than 6.0 mg/L at all times, and a narrative target stating that surface waters shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses. DEQ believes that by keeping TP levels below 0.10 mg/L, and by increasing stream flows, DO levels should remain above 6.0 mg/L and thereby not impair beneficial uses. Low summer flows contributed to the low DO readings in Hatter Creek. To improve the low summer flow condition, water could be retained during the spring runoff in new or improve wetlands and riparian corridors. The water would then be stored at the surface or in shallow groundwater areas and released during the low summer flow periods and thereby improving the DO situation.

The nutrient target was violated a total of five times between at the lower monitoring site. The phosphorus target was violated a total of three times consecutively and the DO target twice. The violation of 0.8 mg/L on 6/18/2002 is several orders of magnitude larger than the other results, and this could have been an error at the lab after collection or an error

committed sometime during the preparation (perhaps in the sample container) during collection or during the transportation and transfer of the sample. DEQ does not consider this to an accurate reading. Even without this reading, there were two other consecutive bi-weekly exceedances of the TP target and three continuous bi-weekly DO exceedances. Based on the frequency and duration of the TP and DO, field reports, and site visits, DEQ believe a nutrient problem exists in Hatter Creek-lower and will write a nutrient TMDL for the lower section of Hatter Creek.



**Figure 2-35. Hatter Creek Total Nitrogen Levels**

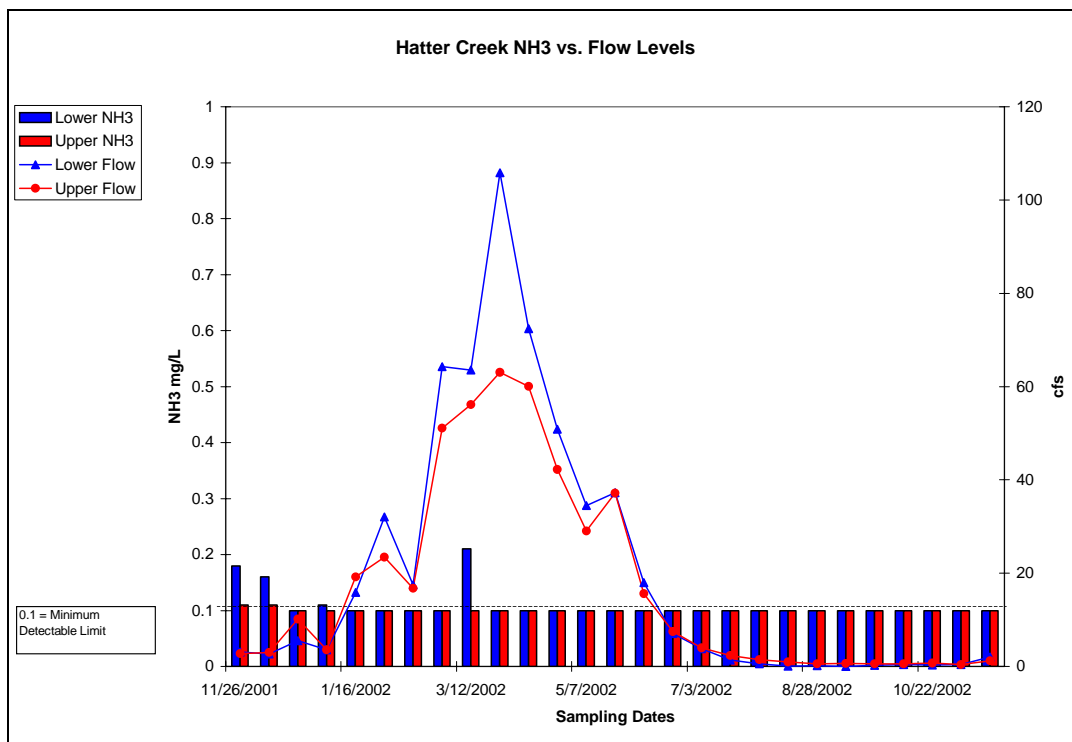


Figure 2-36. Hatter Creek Ammonia Levels

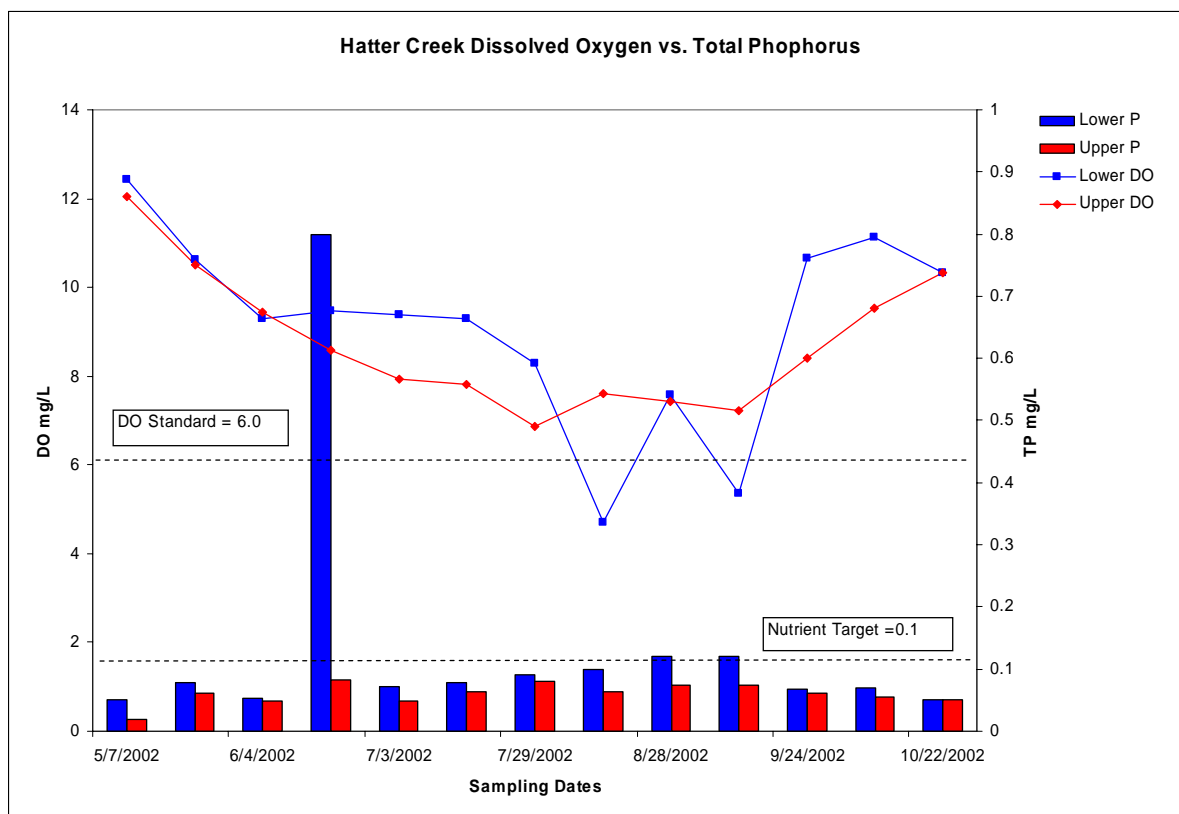
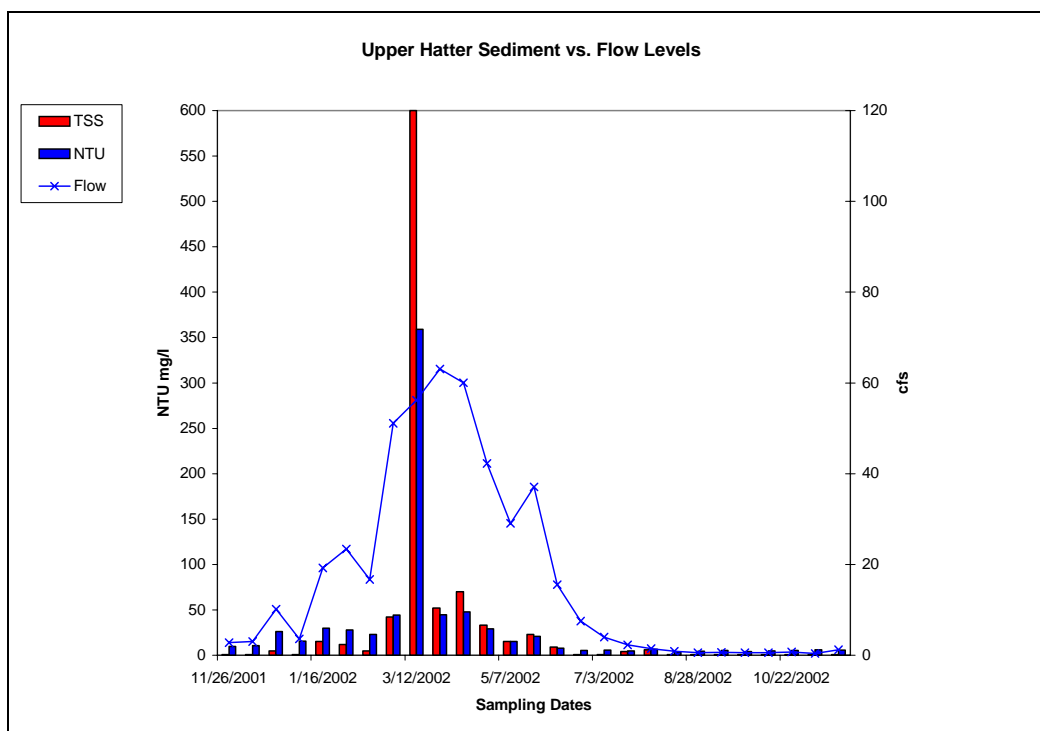
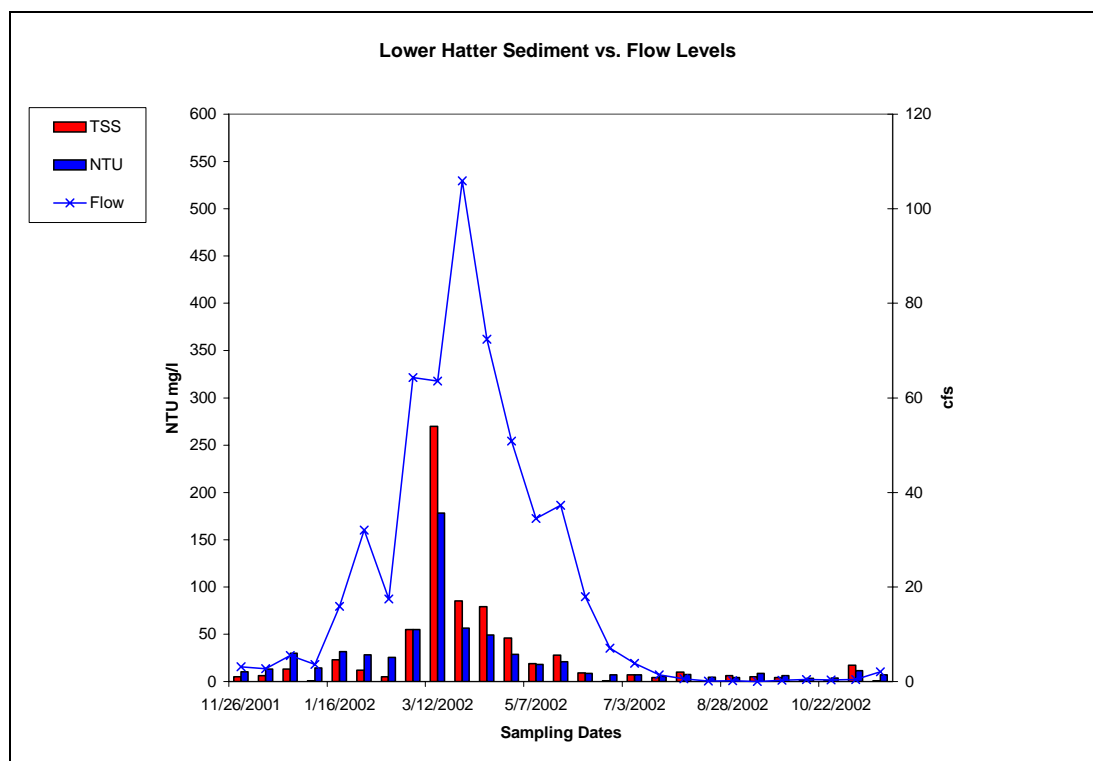


Figure 2-37. Hatter Creek DO versus Phosphorus Levels

**Table 2-9. Hatter Creek TP and DO bi-weekly monitoring results growing season**

Date	PR-12 (TP) <sup>1</sup>	PR-12 (DO) <sup>1</sup>	PR-12 (discharge) <sup>2</sup>	PR-13 (TP) <sup>1</sup>	PR-13 (DO) <sup>1</sup>	PR-13 (discharge) <sup>2</sup>
5/7/2002	0.05	12.42	34.46	0.02	12.06	29.08
5/22/2002	0.08	10.62	37.30	0.06	10.50	37.15
6/4/2002	0.05	9.30	17.94	0.05	9.45	15.58
<b>6/18/2002</b>	<b>0.80</b>	<b>9.46</b>	<b>7.06</b>	0.08	8.58	7.52
7/3/2002	0.07	9.38	3.84	0.05	7.93	4.02
7/16/2002	0.08	9.28	1.39	0.06	7.81	2.33
7/29/2002	0.09	8.28	0.59	0.08	6.87	1.44
<b>8/18/2002</b>	<b>0.10</b>	<b>4.70</b>	<b>0.09</b>	0.06	7.60	0.94
<b>8/28/2002</b>	<b>0.12</b>	<b>7.58</b>	<b>0.18</b>	0.07	7.43	0.55
<b>9/5/2002</b>	<b>0.12</b>	<b>5.35</b>	<b>0.01</b>	0.07	7.23	0.63
9/24/2002	0.07	10.66	0.25	0.06	8.42	0.60

Exceedance shown in **bold**<sup>1</sup> mg/L<sup>2</sup> cfs**Figure 2-38. Hatter Creek –Upper- Sediment Levels**



**Figure 2-39. Hatter Creek –Lower- Sediment Levels**

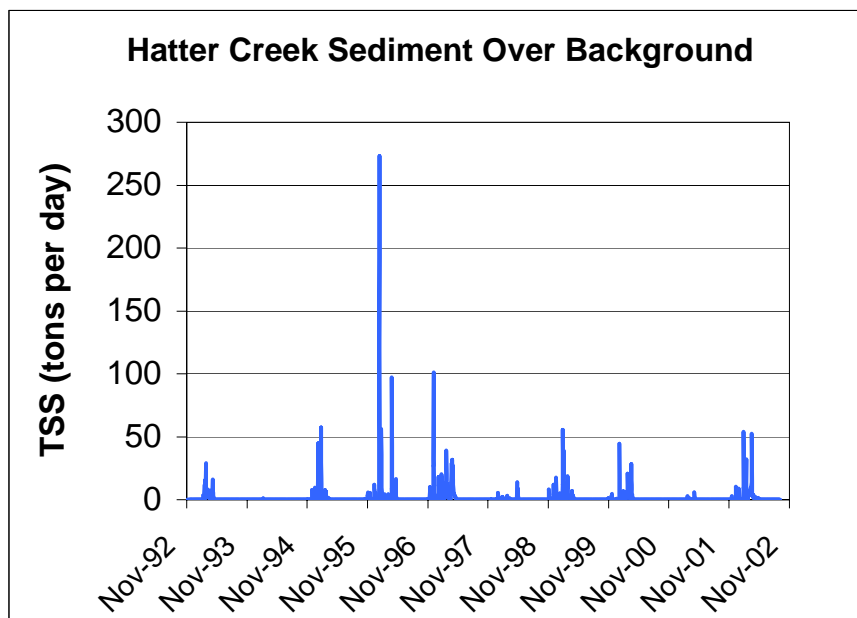
Total suspended solids (TSS), expressed in mg/L, turbidity, expressed in nephelometric turbidity units (NTU), and discharge, expressed in cubic feet per second (cfs), for the upper and lower monitoring sites, are displayed in Figures 2-38 and 2-39. TSS is a weighted measure of the total solid concentrations in the water, whether the particles are mineral (such as soil particles) or organic (such as plants). An NTU is a measure of turbidity based on a comparison of the intensity of the light scattered by the sample under defined conditions with the intensity of the light scattered by a standard reference suspension under the same conditions. These two measures are the standard indicators for sediment level concentration in surface water applications nationwide. Idaho State Standards for sediment state that sediment levels shall not impair designated beneficial uses and that turbidity shall not exceed background turbidity by more than 50 NTU instantaneously or more than 25 NTU for more than ten consecutive days.

Figures 2-38 and 2-39 display data that was collected approximately every two weeks for the period November 2001-November 2002. To determine if sediment levels were above state standards and impairing beneficial uses, additional calculations and assumptions were made. First, a more thorough discharge profile for Hatter Creek was developed. This profile is based on ten years of data collected at the USGS Palouse River gage site, watershed size differences

between Hatter Creek and the Palouse River, and in-stream flows collected for Hatter Creek during November 2001-November 2002.

The data shown displays numeric relationships between discharge and NTU, discharge and TSS, and NTU and TSS. These relationships can be expressed as mathematical equations,

called regression equations. The regression equations used to calculate values for TSS, NTU, background TSS, background NTU, and TSS levels over background, are located in Appendix B. Figure 2-40 is a graph of the sediment level amounts over background for Hatter Creek over a ten-year period. Based on the sediment data collected, the mathematical relationships established in this TMDL, and previous BURP data, sediment levels over background are impairing beneficial uses; therefore a sediment TMDL will be developed for Hatter Creek.



**Figure 2-40. Hatter Creek –Sediment Levels over Background**

### West Fork Rock Creek

The West Fork Rock Creek (WFRC) is 303(d)-listed for sediment, temperature, nutrients, and bacteria. The boundaries are defined as headwaters to Palouse River. Technically this includes only the WFRC and the lower section of Rock Creek. For this report, the entire Rock Creek Watershed was evaluated. Therefore, for this report, the WFRC is called Rock Creek and includes the entire watershed, the West Fork of Rock Creek, the East Fork Rock and Rock Creek.

Rock Creek is a third order stream at its confluence with Palouse River. The headwaters originate off the north side of Rocky Point. The entire basin is shown on Map 2-6. The Rock Creek Watershed is 8.09 square miles in size (5,180 acres) and is the smallest 303(d) listed watershed.

Most of the land in Rock Creek is under private land ownership. The State of Idaho and Bennett Lumber own and manage very small portions along the western watershed boundary. The primary land uses are agriculture, forestry, grazing, and recreational activities. Rock Creek generally flows from the south to the north, and the basic drainage pattern could be described as dendritic. Elevations range from 2,503 feet to 3,737 feet. The geology of the

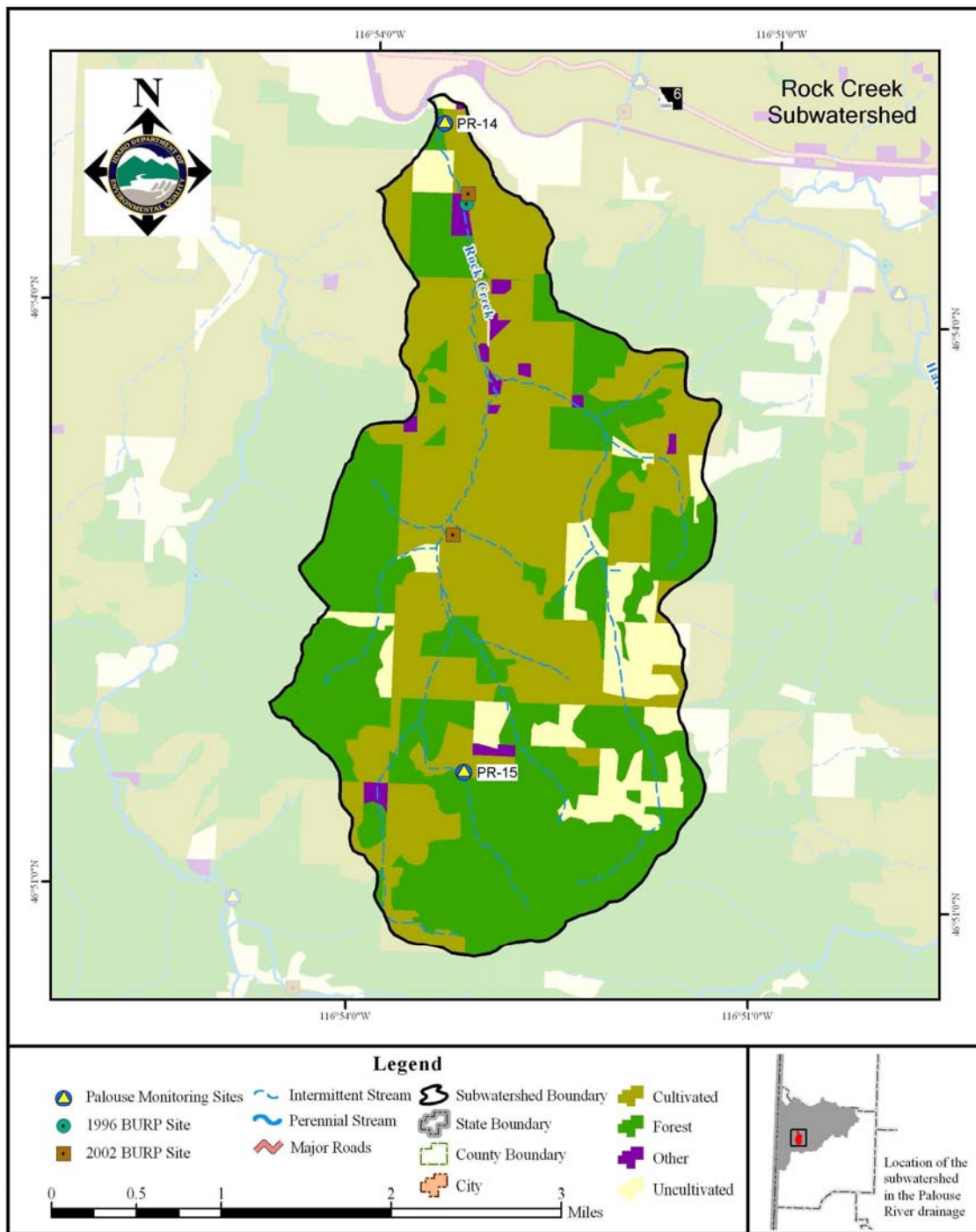
upper watershed is weathered granitics while the mid to lower portions of the watershed is dominated by the Palouse Loess. Metaphorized granitics underlay the Palouse Loess in the lower half of the watershed. In the valley bottoms, along the Rock Creek, coarse textured alluvium sediment deposition is present.

The WFRC and EFRC join together in the middle of the watershed to form Rock Creek. The upper monitoring site (PR-15) is in the headwaters of the WFRC, near the forest-to-agricultural land use boundary. The lower monitoring site (PR-14) is less than a mile from the mouth. The main road for access into this watershed parallels the main stem Rock Creek for many miles.

Based on the flow data that has been collected on Rock Creek, Rock Creek is an intermittent stream that goes completely dry during a period of the year. Both sites on Rock Creek were completely dry from the latter half of July through October 2002. In early August 1996, and again in early July 2002, both BURP sites were dry. In 2003, the lower site was dry in July and August.

Rock Creek is classified as an intermittent stream according to the USGS quad map. IDAPA 58.01.02.070.06 states “numeric standards only apply to intermittent waters during optimum flow periods sufficient to support the uses for which the water body is designated. For recreation, the optimum flow is equal to or greater than five cfs. For aquatic life uses, optimum flow is equal to or greater than 1 cfs.”

DEQ was unable to find any fish data for Rock Creek although it is suspected that Rock Creek supports dace, red-side shiners, and suckers. In the upper tributaries, there may be pockets of salmonids and sculpin



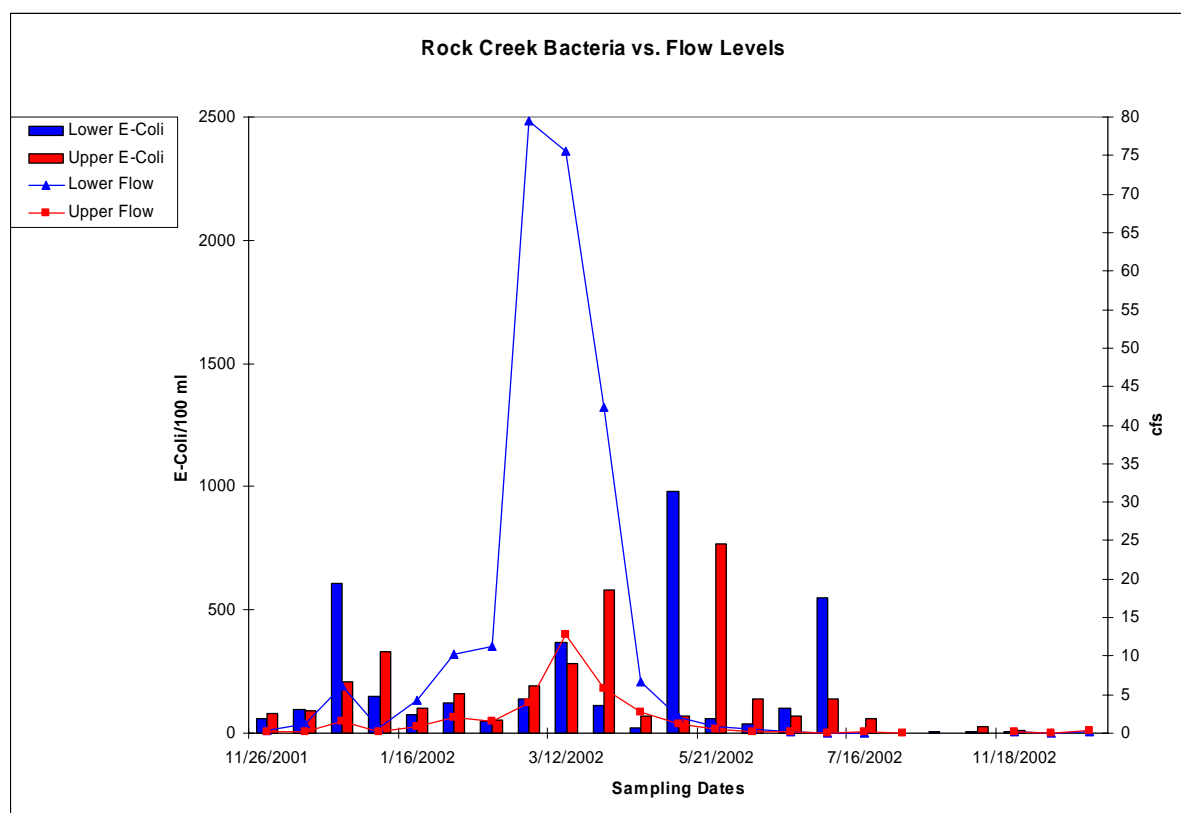
**Map 2-6. Rock Creek Subwatershed**

### Status of beneficial uses

Results from the 2001-2002 field season are displayed in Figures 2-41 through 2-48. Sediment and bacteria in Rock Creek are impairing beneficial uses. Temperature and

nutrients were found not to be impairing beneficial uses, primarily based on the intermittent classification of Rock Creek. When temperature and nutrient levels exceeded state standards or TMDL proposed targets, stream flows were below 1 cfs. Aquatic life beneficial uses do not apply for flows below 1 cfs on intermittent streams. Based on these facts, DEQ is proposing to de-list Rock Creek for temperature and nutrients and write TMDLs for sediment and bacteria. An informational temperature TMDL was included in Appendix F for use as a reference and for guidance during implementation.

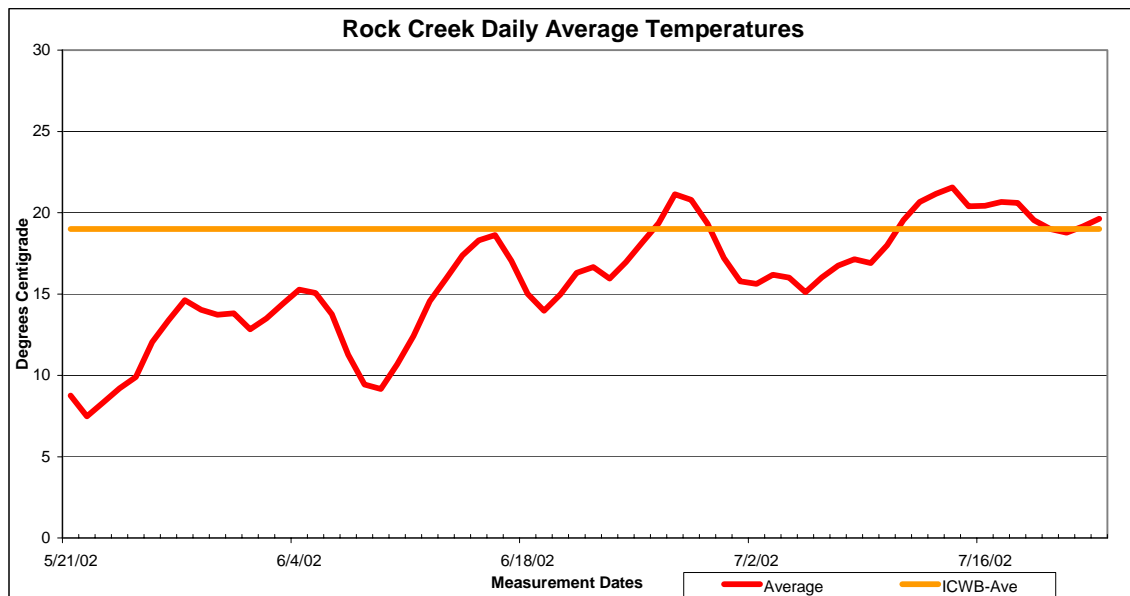
Bacteria data displayed in Figure 2-41 shows four exceedances (two at each site) of the state bacteria standard for secondary contact recreation during the 2001-2002 monitoring season. The exceedances in December of 2001 and in March of 2002 occurred when flows were greater than 5 cfs. The latter two exceedances occurred when flows were less than 5 cfs, and were not included for the TMDL reduction calculations in Chapter Five. Based on this data and field observations, Rock Creek is water quality impaired by bacteria and will have a bacteria TMDL written.



**Figure 2-41. Rock Creek Bacteria Levels**

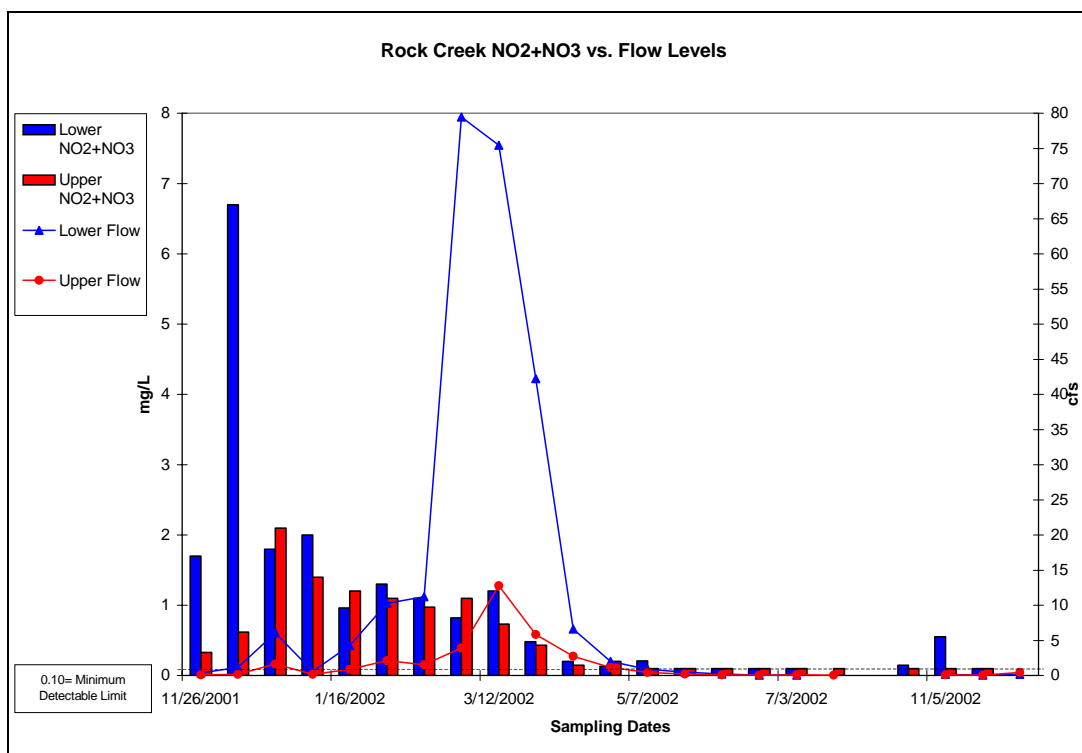
A continuous temperature data-logger probe was placed near the lower-monitoring site (PR-14). The probe recorded temperature readings every hour from mid-May 2002 through late July 2002.

Rock Creek is an intermittent stream that went dry in late July 2002. Flows went below 1 cfs on or before May 7, 2002 and remained below 1 cfs through the end of our monitoring on November 18, 2002. No salmonids are present in Rock Creek, therefore the Idaho salmonid spawning daily average (ISS-Ave) of 9° C does not apply. Figure 2-42 displays the results of Rock Creek when water was flowing. The probe was removed after Rock Creek went completely dry in late July 2002. During June and July, temperatures exceed the Idaho cold water aquatic life daily average (ICWB-Ave) of 19° C; however, it was after flows went below 1 cfs. Therefore DEQ will not write a temperature TMDL for Rock Creek and recommends that Rock Creek be de-listed for temperature as a possible pollutant.

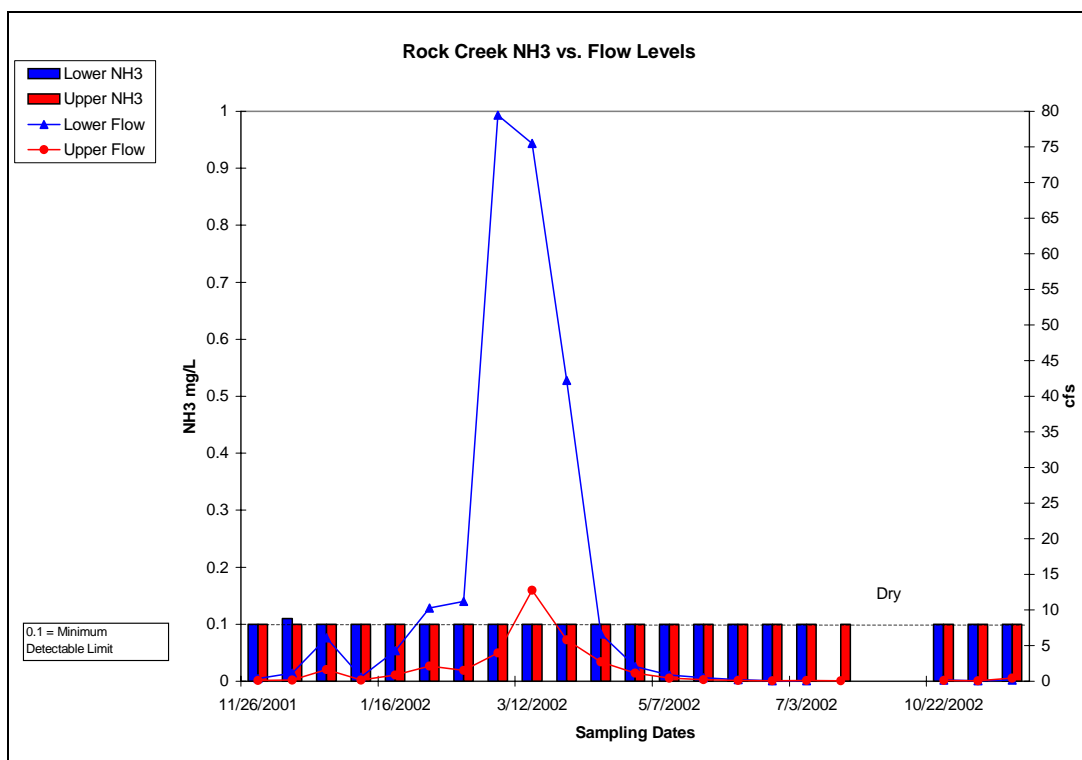


**Figure 2-43. Rock Creek Temperature**

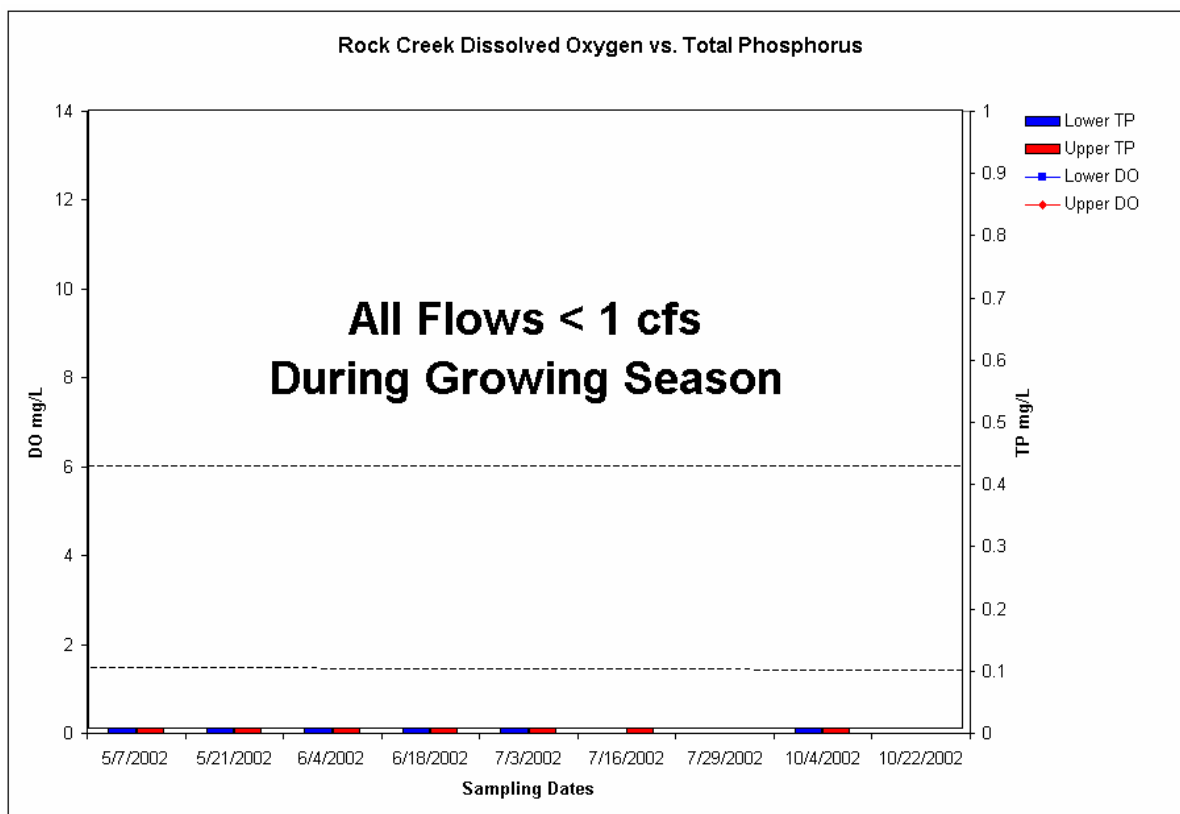
The nutrient data are displayed in Figures 2-43 through 2-45. High nitrogen levels were recorded during the late fall, winter, and early spring months at both sites. Nutrient levels at the lower site were higher than that of the upper site, which would correlate to the change in land use from forestry to agriculture. Ammonia levels were at the minimum detection limit except for one time when the value was 0.01 mg/L above the minimum detectable limit. These values are well within state standards for ammonia. During the growing season, May through October, the discharge (flow) for Rock Creek is below 1 cfs; therefore, aquatic life uses do not apply. Based on the intermittent status of Rock Creek, a nutrient TMDL is not required, and DEQ recommends that Rock Creek be de-listed from the 303(d) list for nutrients.



**Figure 2-43. Rock Creek Total Nitrogen Levels**



**Figure 2-44. Rock Creek Ammonia Levels**

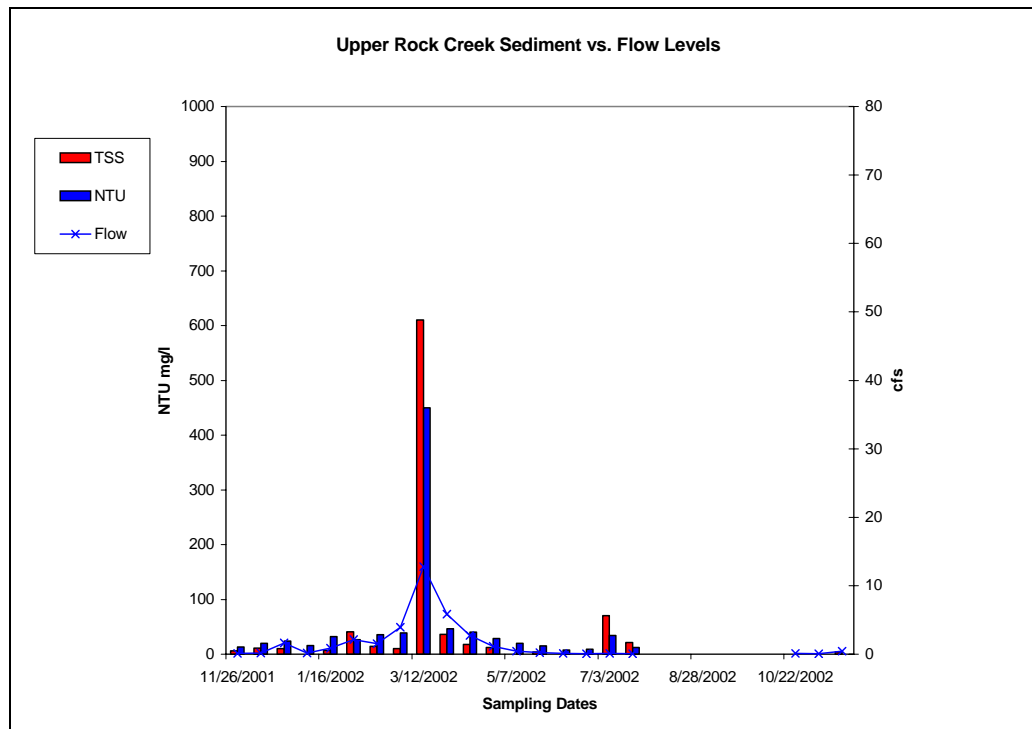


**Figure 2-45. Rock Creek DO versus Phosphorus Levels**

Total suspended solids (TSS), expressed in mg/L, turbidity, expressed in nephelometric turbidity units (NTU), and discharge, expressed in cubic feet per second (cfs), for the upper and lower monitoring sites, are displayed in Figures 2-46 and 2-47. TSS is a weighted measure of the total solid concentrations in the water, whether the particles are mineral (such as soil particles) or organic (such as plants). An NTU is a measure of turbidity based on a comparison of the intensity of the light scattered by the sample under defined conditions with the intensity of the light scattered by a standard reference suspension under the same conditions. These two measures are the standard indicators for sediment level concentration in surface water applications nationwide. Idaho State Standards for sediment state that sediment levels shall not impair designated beneficial uses and that turbidity shall not exceed background turbidity by more than 50 NTU instantaneously or more than 25 NTU for more than ten consecutive days.

Figures 2-46 and 2-47 display data that was collected approximately every two weeks for the period November 2001–November 2002. To determine if sediment levels were above state standards and impairing beneficial uses, additional calculations and assumptions were made. First, a more thorough discharge profile for Rock Creek was developed. This profile is based on ten years of data collected at the USGS Palouse River gage site, watershed size differences between Rock Creek and the Palouse River, and in-stream flows collected for Rock Creek during November 2001–November 2002.

The data shown displays numeric relationships between discharge and NTU, discharge and TSS, and NTU and TSS. These relationships can be expressed as mathematical equations, called regression equations. The regression equations used to calculate values for TSS, NTU, background TSS, background NTU, and TSS levels over background are located in Appendix B. Figure 2-46 is a graph of the sediment level amounts over background for Rock Creek over a ten-year period. Based on the sediment data collected, the mathematical relationships established in this TMDL, and previous BURP data, sediment levels over background are impairing beneficial uses; therefore a sediment TMDL will be developed for Rock Creek.



**Figure 2-46. Rock Creek–Upper Sediment Levels**

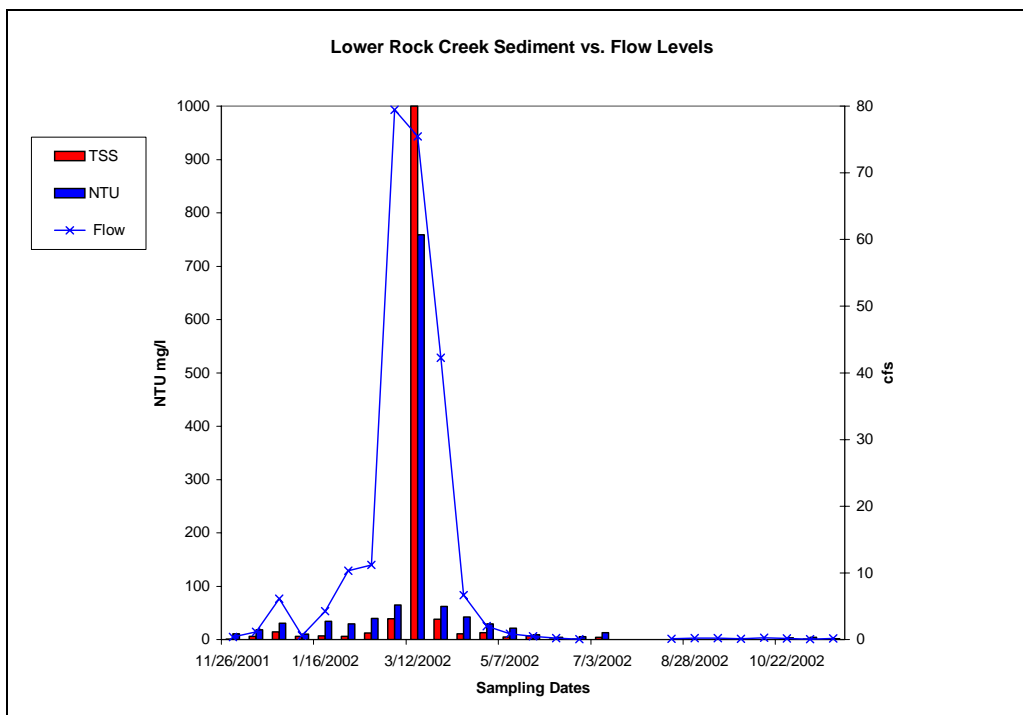


Figure 2-47. Rock Creek–Lower-Sediment Levels

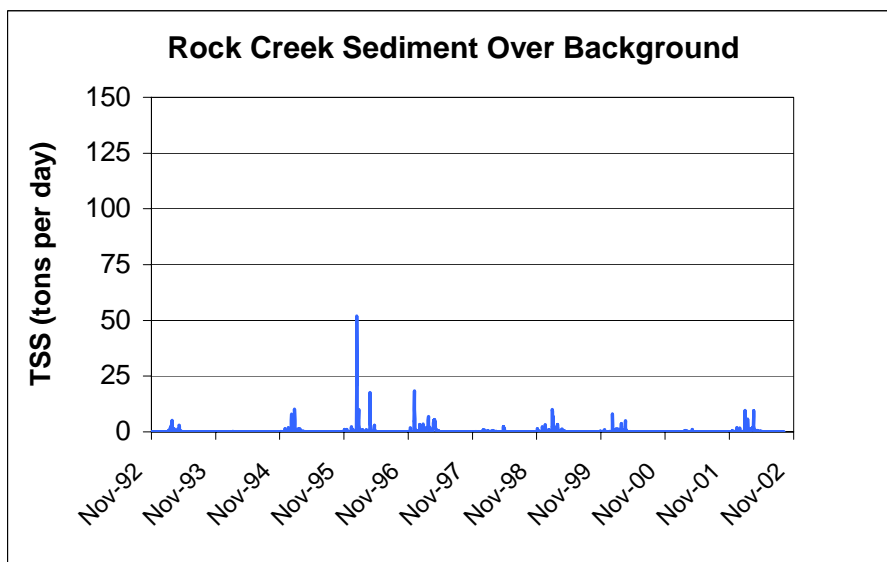


Figure 2-48. Rock Creek–Sediment Levels over Background

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